

FILE NO. SM-CTV-O-043

COLOR TELEVISION

SERVICE MANUAL

MODEL NO. AT2008S/AT2008
CHASSIS NO. CN-12C1

Please read this manual carefully before service

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SAFETY INSTRUCTIONS

WARNING: BEFORE SERVICING THIS CHASSIS, READ THE "X-RAY RADIATION PRECAUTION", "SAFETY PRECAUTION" AND "PRODUCT SAFETY NOTICE" INSTRUCTIONS BELOW.

X-RAY RADIATION PRECAUTION

1. The EHT must be checked every time the TV is serviced to ensure that the CRT does not emit X-ray radiation as result of excessive EHT voltage. The nominal EHT for this TV is $25.5 \pm 1.5\text{KV}$ at zero beam current (minimum brightness) operating at AC 120V. The maximum EHT voltage permissible in any operating circumstances must not exceed 28KV. When checking the EHT, use the High Voltage Check procedure in this manual using an accurate EHT voltmeter.
2. The only source of X-RAY radiation in this TV is the CRT. To prevent X-ray radiation, the replacement CRT must be identical to the original fitted as specified in the parts list.
3. Some components used in this TV have safety related characteristics preventing the CRT from emitting X-ray radiation. For continued safety, replacement component should be made after referring the PRODUCT SAFETY NOTICE below.

SAFETY PRECAUTION

1. The TV has a nominal working EHT voltage of 24.5KV. Extreme caution should be exercised when working on the TV with the back removed.
 - 1) Do not attempt to service this TV if you are not conversant with the precautions and procedures for working on high voltage equipment.
 - 2) When handling or working on the CRT, always discharge the anode to the TV chassis before removing the anode cap in case of electric shock.
 - 3) The CRT, if broken, will violently expel glass fragments. Use shatterproof goggles and take extreme care while handling.
 - 4) Do not hold the CRT by the neck as this is a very dangerous practice.
2. It is essential that to maintain the safety of the customer all power cord forms be replaced exactly as supplied from factory.
3. Voltage exists between the hot and cold ground when the TV is in operation. Install a suitable isolating transformer of beyond rated overall power when servicing or connecting any test equipment for the sake of safety.
4. Replace blown fuses within the TV with the fuse specified in the parts list.
5. When replacing wires or components to terminals or tags, wind the leads around the terminal before soldering. When replacing safety components identified by the international hazard symbols in the circuit diagram and parts list, it must be the company-approved type and must be mounted as the original.
6. Keep wires away from high temperature components.

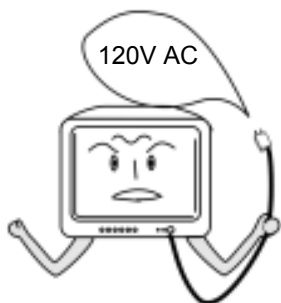
SAFETY INSTRUCTIONS(continued)

PRODUCT SAFETY NOTICE

Many electrical and mechanical components in this chassis have special safety-related characteristics. These characteristics are often passed unnoticed by a visual inspection and the X-ray radiation protection afforded by them cannot necessarily be obtained by using replacements rated at higher voltages or wattage, etc. Components which have these special safety characteristics in this manual and its supplements are identified by the international hazard symbols on the schematic diagram and parts list. Before replacing any of these components read the parts list in this manual carefully. Substitute replacement components which do not have the same safety characteristics as specified in the parts list may create X-ray radiation.

PRECAUTIONS

Power Sources-The TV set should be operated only from the type of power source indicated on the TV set or as indicated in the Service Manual. If you are not sure of the type of power supply in your home, consult your sales person or your local power company. For TV sets designed to operate from battery power, or other sources, refer to the operating instructions.

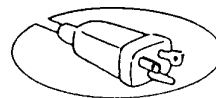


Grounding or Polarization-Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.



Wide blade
Lame large
Cuchilla ancha

Alternate Warnings-A three wire grounding type plug-a plug having a third (grounding) pin. This plug will only fit into grounding type power outlet.



Water and Moisture Warnings-Do not use the TV set near water-for example, near a bath tub, wash bowl, kitchen sink, or laundry tub; in a wet basement; or near a swimming pool; and the like. The TV set shall not be exposed to dripping or splashing and no objects filled with liquids, such as vases, shall be placed on the TV set.



Ventilation-Slots and openings in the cabinet are provided for ventilation and to ensure reliable operation of the TV set and to protect it from overheating, and these openings must not be blocked or covered. The openings should never be blocked by placing the TV set on a bed, sofa, rug, or other similar surface. This TV set should not be placed in a built-in installation such as a bookcase or rack unless proper ventilation is provided or the manufacturer's instructions have been adhered to.

SPECIFICATIONS (AT2008S, AT2008)

Television system:	NTSC-M
Channel coverage:	VHF 2~13 UHF 14~69 CABLE TV:MID BAND (A-8~A-1, A~I) SUPER BAND (J~W) HYPER BAND (AA~ZZ, AAA, BBB) ULTRA BAND (65~94, 100~125)
Channels preset:	181
Antenna input:	75 Ω (unbalanced)
Picture tube:	Effective screen dimensions: 406mm×305mm (15.98×12.01 in.) (Approx.)
Audio output:	2W+2W (for AT2008S only); 2W×2 (for AT2008 only) (THD≤7%)
Power source:	~120Vac 60Hz
Weight:	25kg (55 lbs) (Approx.)
Dimensions (W/H/D):	566×450×477mm (22.28×17.72×18.78 in.) (Approx.)
Packing dimensions (W/H/D):	640×531×540mm (25.20×20.91×21.26 in.) (Approx.)
Rated power consumption:	~90W

Designs and specifications are subject to change without notice.

KEY ICS AND ASSEMBLIES

Table 1 Key ICs and Assemblies

Serial No.	Position No.	Model No.	Function Description
1	N101	LA76814	Small signal processor
2	N301	LA7840	Vertical output circuit
3	N503	L7805	Tri-terminal regulator
4	M181	TDA7057AQ	Sound power amplifier(For AT2008S only)
5	N181	TDA7056B	Sound power amplifier(For AT2008 only)
6	D701	L6F3248A	Microcontroller
7	D701	AT24C08	EEPROM
8	MS181	M52470AP	Analog switch circuit(For AT2008S only)
9	U101	TDQ-3B8/136-F	Tuner

SYSTEM BLOCK DIAGRAMS (CONTINUED)

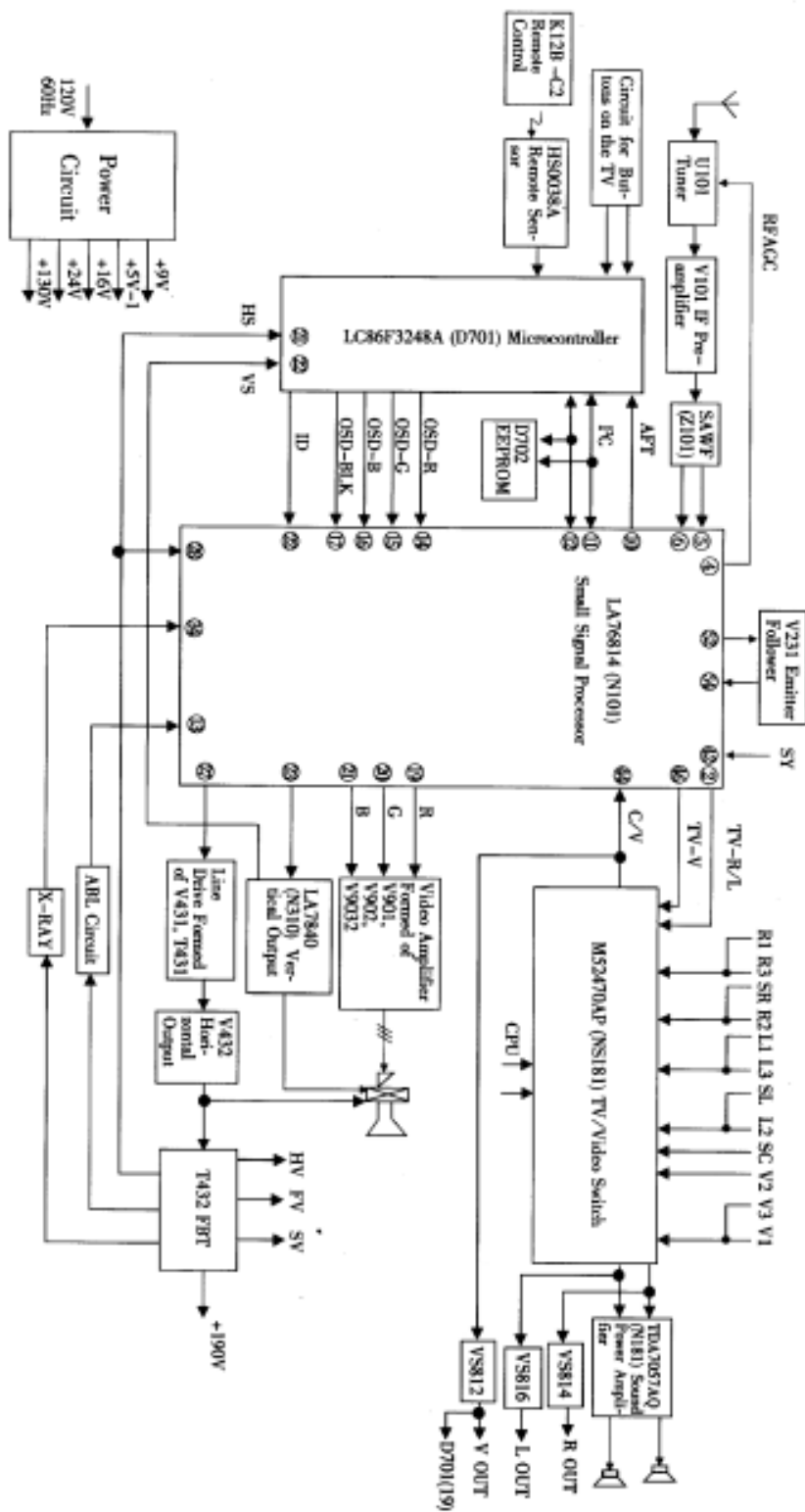


Fig. 1 Structure Block Diagram for CN-12C1 Chassis (for AT2008S only)

SYSTEM BLOCK DIAGRAMS (CONTINUED)

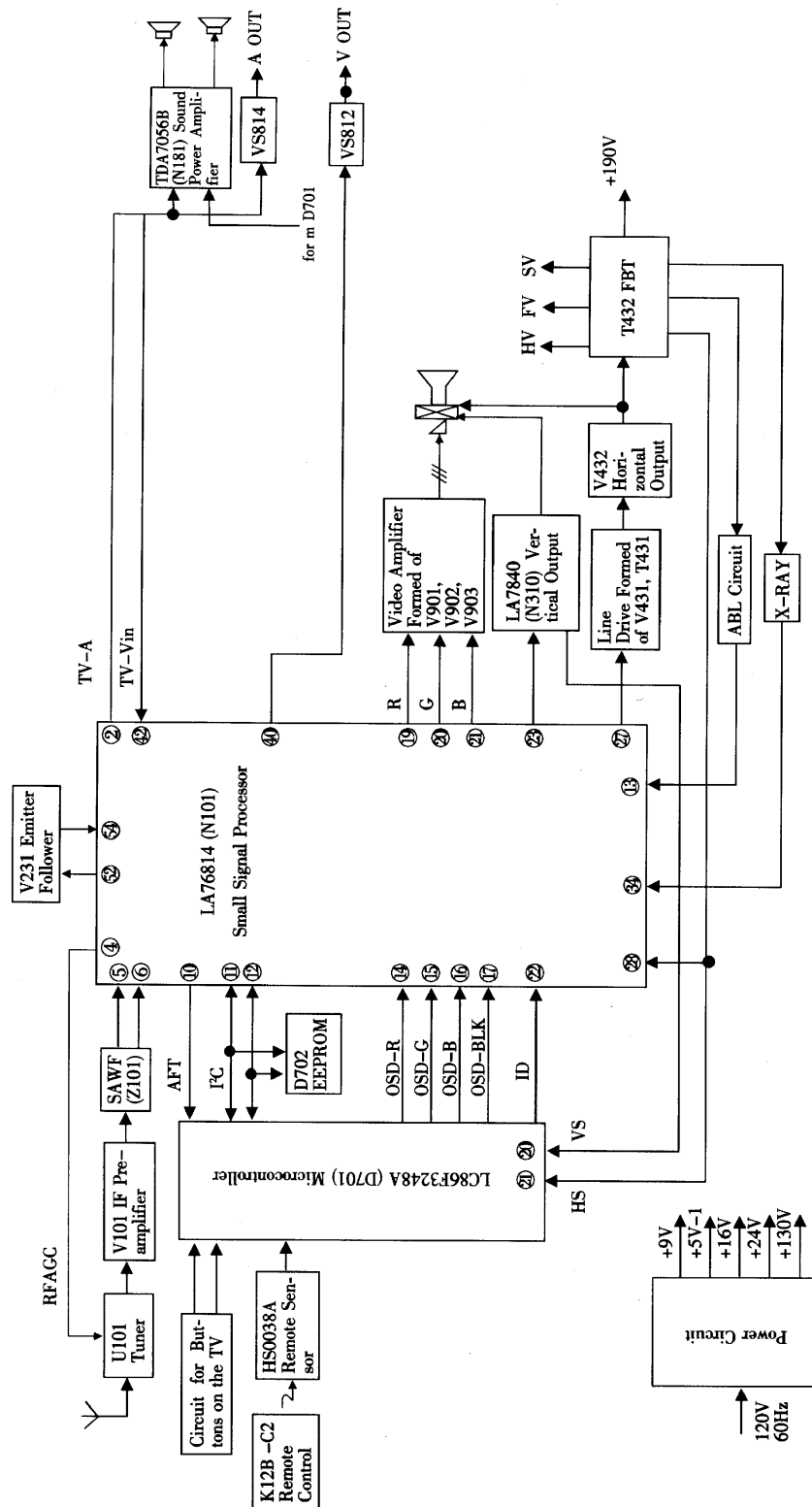


Fig. 2 Structure Block Diagram for CN-12C1 Chassis (for AT2008 only)

SYSTEM BLOCK DIAGRAMS (CONTINUED)

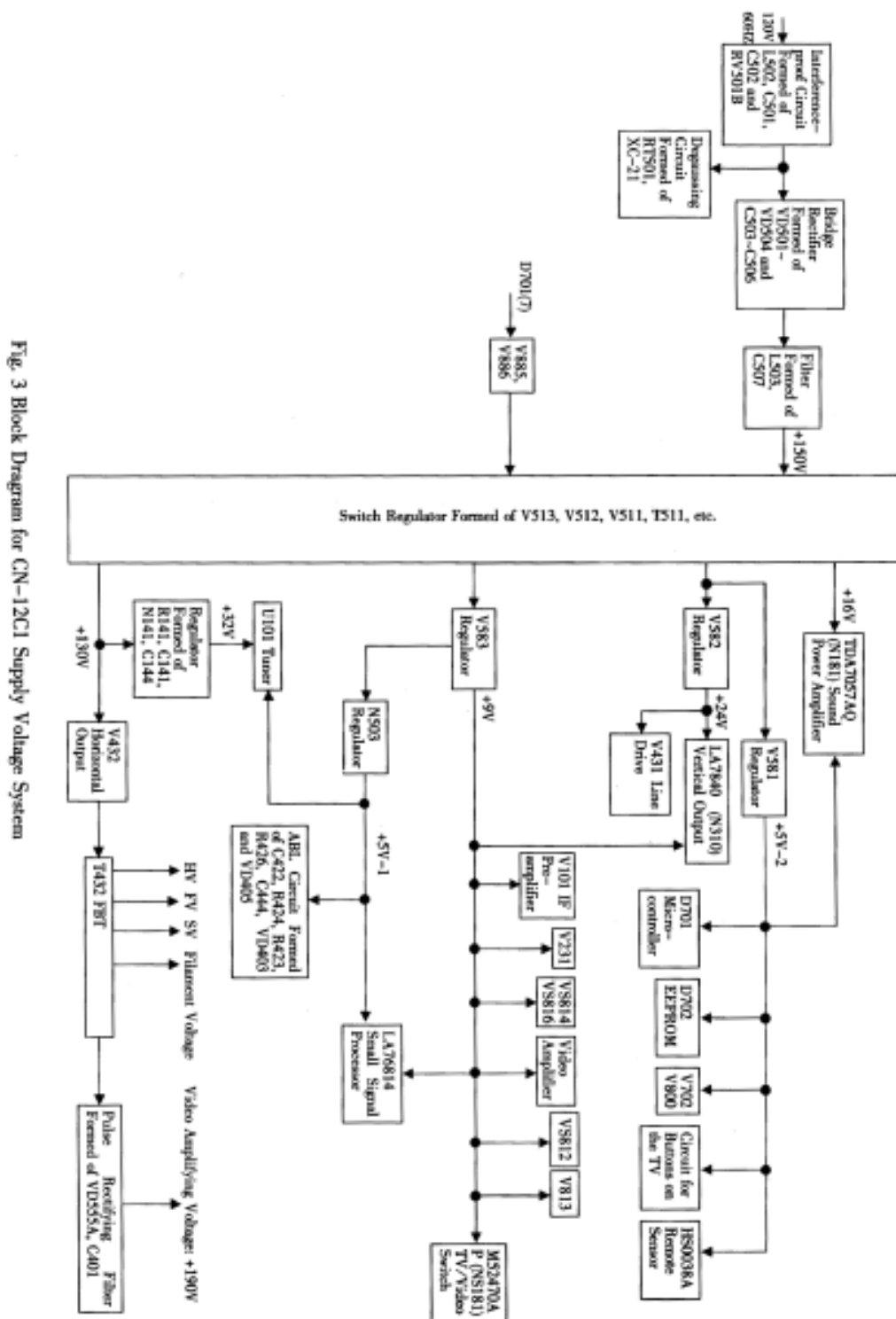


Fig. 3 Block Diagram for CN-12C1 Supply Voltage System

SYSTEM BLOCK DIAGRAMS (CONTINUED)

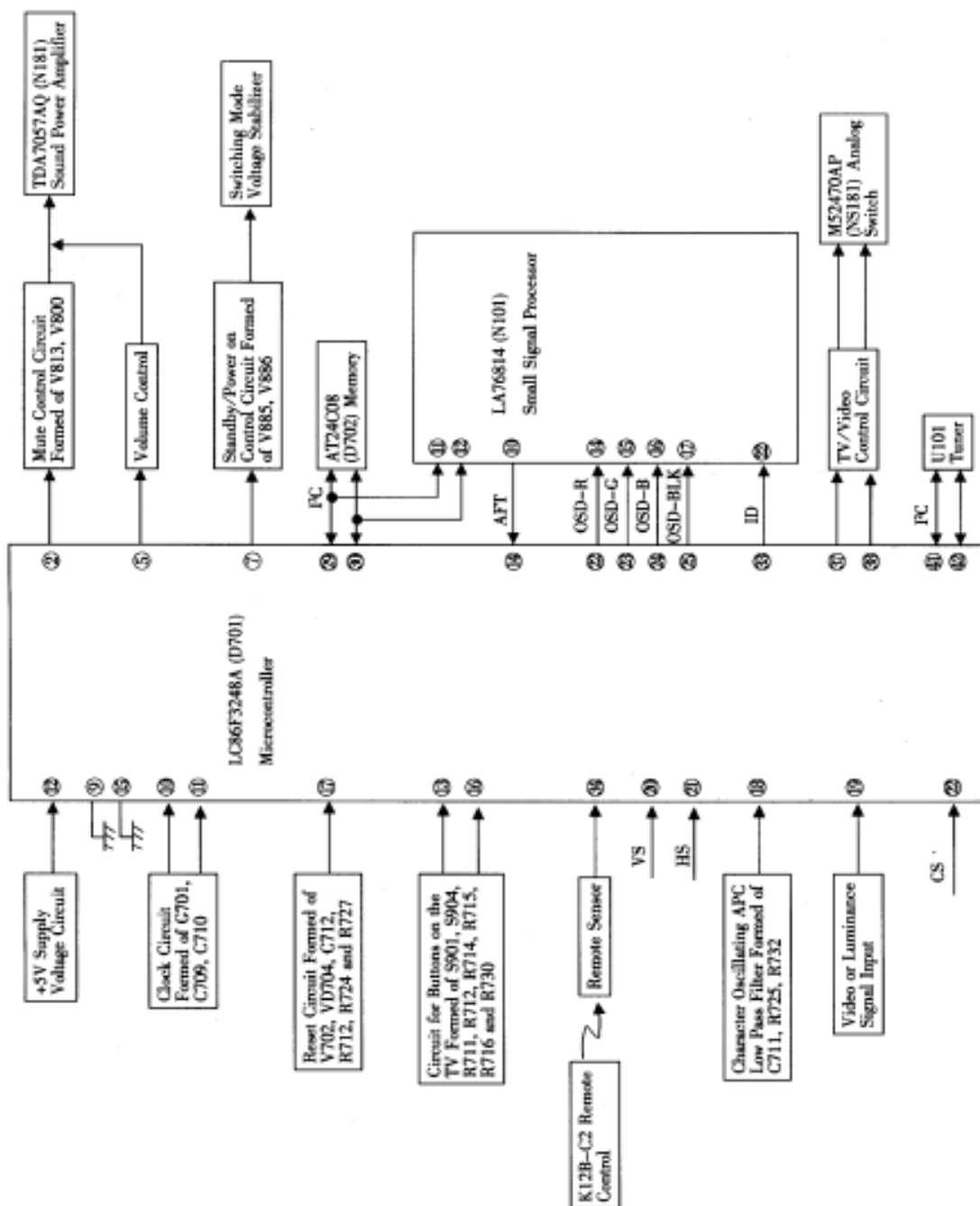


Fig. 4 Block Diagram for CN-12C1's Remote Control Structure

IC DATA AND WAVEFORMS OF KEY POINTS

LA76814 Small Signal Processing IC

1. Introduction of LA76814 IC

LA76814 is a NTSC-M only system color TV specific monolithic IC developed by SANYO Co., which is controlled by Inter IC Bus. LA76814 includes a IF processing circuit, a luminance and chroma signal processing circuit, horizontal/frame scanning small signal processing circuit etc. It has following features.

*Number of external component adjustments reduced by the use of an I²C bus and by reducing the number of on-board rheostats.

An I²C bus is used for controlling this IC, and this allows the number of adjustment that require trimmers on the printed circuit board to be reduced.

*Number of adjustments reduced by the adoption of adjustment-free technology. The VCO coil adjustment and the AFT coil adjustment are now handled by adjustment-free technology.

*Number of external components reduced by the adoption of circuit technologies.

-S-TRAP, S-BPF

The sound trap and sound bandpass filter circuits, which were previously implemented using external components, are now provided on chip.

-Horizontal oscillator element

The horizontal oscillator element, which was previously an external component is now provided on chip.

-Single crystal operation provided by DDS technology

The functions of the two or three crystal oscillator elements previously required for color demodulation can now be handled by a single crystal oscillator element due to the adoption of DDS technology.

[illegible]

3. Refer to Table 2 about Functions and Service Data of LA76814' s Pins.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

TDA7057AQ (N181)

2×8W Stereo BTL Audio Output Amplifier with DC Volume Control

1. Features

- DC volume control
- Few external components
- Mute mode
- Thermal protection
- Short-circuit proof
- No switch-on and switch-off clicks
- Good overall stability
- Low power consumption
- Low HF radiation
- ESD protected on all pins.

2. General Description

The TDA7057AQ is a stereo BTL output amplifier with DC volume control. The device is designed for use in d TVs and monitors, but is also suitable for battery-fed portable recorders and radios.

Missing Current Limiter (MCL)

A MCL protection circuit is built-in. The MCL circuit is activated when the difference in current between the out put terminal of each amplifier exceeds 100 mA (typical 300 Ma). This level of 100 mA allows for single-ended headphone applications.

3. Block Diagram

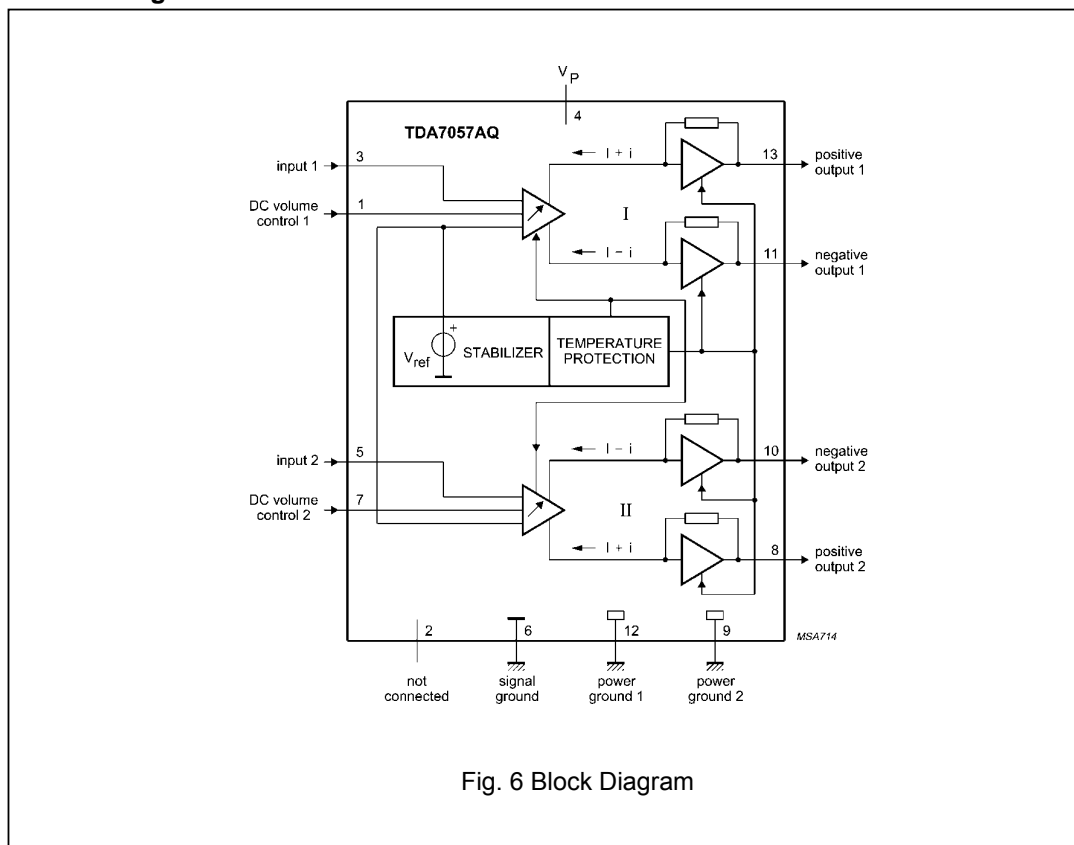


Fig. 6 Block Diagram

4. Refer to Table 3 about Functions and Service Data of TDA7057AQ's Pins.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

TDA7056B(N181)

5W mono BTL audio amplifier with DC volume control

1. Features

- DC volume control
- Few external components
- Mute mode
- Thermal protection
- Short-circuit proof
- No switch-on and switch-off clicks
- Good overall stability
- Low power consumption
- Low HF radiation
- ESD protected on all pins.

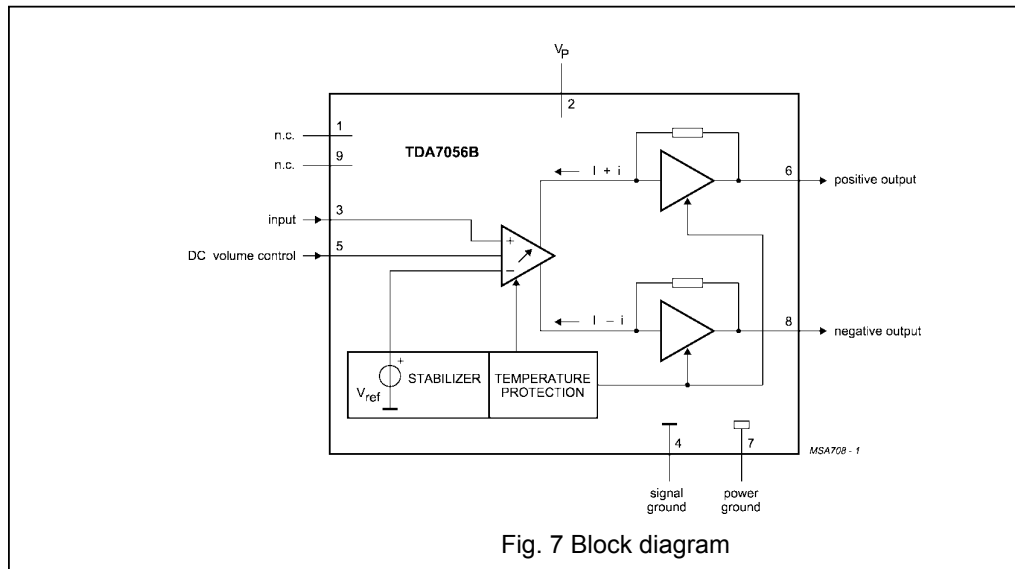
2. General Description

The TDA7056B is a mono Bridge-Tied Load (BTL) output amplifier with DC volume control.

It is designed for use in TV and monitors, but is also suitable for battery-fed portable recorders and radios. The device is contained in a 9-pin medium power package.

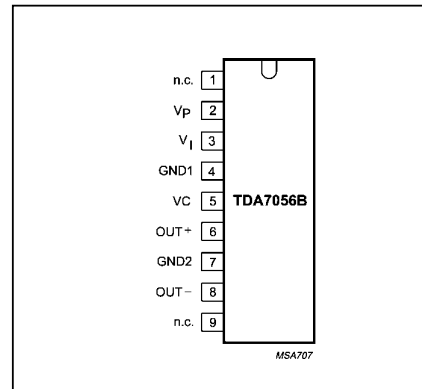
A Missing Current Limiter (MCL) is built in. The A MCL circuit is activated when the difference in current between the output terminal of each amplifier exceeds 100 mA (300 mA typ). This level of 100 mA allows for headphone applications (single-ended)

3. Block Diagram



4. Pinning

Symbol	Pin	Description
n.c.	1	Not connected
VP	2	Positive supply voltage
VI	3	Voltage input
GND1	4	Signal ground
VC	5	DC volume control
OUT+	6	Positive output
GND2	7	Power ground
OUT-	8	Negative output
n.c.	9	Not connected



5. Refer to Table 8 about Functions and Data of the IC' s Each Pin.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

LC86F3248A (D701)

8-Bit Single Chip Microcontroller

1. Overview

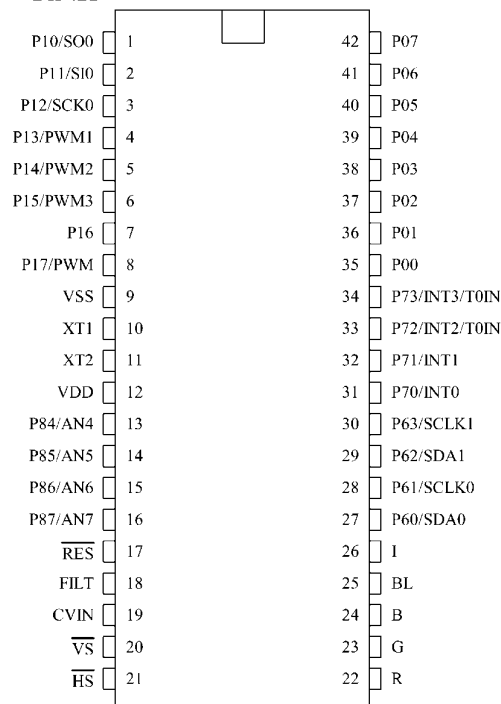
The LC863264/56/48/40A are 8-bit single chip microcontrollers with the following on-chip functional blocks:

- CPU: Operable at a minimum bus cycle time of 0.42 μ s
- On-chip ROM capacity
 - Program ROM: 64K/56K/48K/40K bytes
 - CGROM: 16K bytes
- On-chip RAM capacity: 640 bytes
- OSD RAM: 352×9 bits
- Closed-Caption TV controller and the on-screen display controller
- Closed-Caption data slicer
- Four channels×8-bit AD Converter
- Three channels×7-bit PWM
- Two 16-bit timer/counters, 14-bit base timer
- 8-bit synchronous serial interface circuit
- IIC-bus compliant serial interface circuit (Multi-master type)
- ROM correction function
- 16-source 10-vectored interrupt system
- Integrated system clock generator and display clock generator
 - Only one X' tal oscillator (32.768kHz) for PLL reference is used for both generators
 - TV control and the Closed Caption function

All of the above functions are fabricated on a single chip.

2. Terminal Assignment Layout

• DIP42S



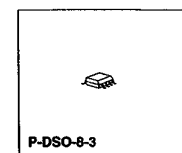
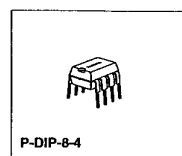
3. Refer to Table 4 about Functions and Service Data of D701's Pins.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

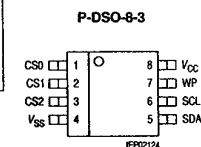
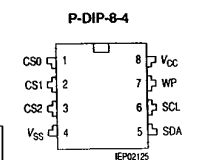
AT24C08 (D702) EEPROM

1. Features

- Data EEPROM internally organized as 1024/2048 bytes and 64/128 pages×16 bytes
- Page protection mode, flexible page-by-page hardware write protection
- Additional protection EEPROM of 64/128 bits, 1 bit per data page
- Protection setting for each data page by writing its protection bit
- Protection management without switching WP pin
- Low power CMOS
- Vcc=2.7 to 5.5V operation
- Two wire serial interface bus, I²C-Bus compatible
- Filtered inputs for noise suppression with Schmitt trigger
- Clock frequency up to 400 kHz
- High programming flexibility
- Internal programming voltage
- Self timed programming cycle including erase
- Byte-write and page-write programming, between 1 and 16 bytes
- Typical programming time 6 ms(<10ms) for up to 16 bytes
- High reliability
- Endurance 10⁶ cycles¹⁾
- Data retention 40 years¹⁾
- ESD protection 4000 V on all pins
- 8 pin DIP/DSO packages
- Available for extended temperature ranges
- Industrial: -40°C to +85°C
- Automotive: -40°C to +125°C



2. Pin Configuration



3. Block Diagram

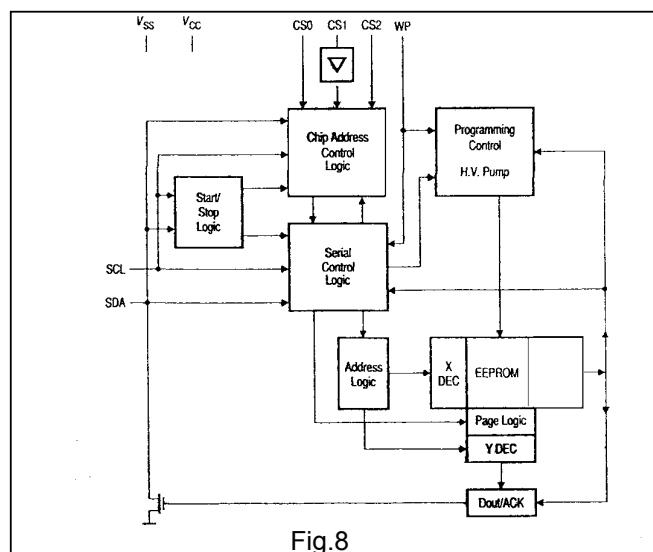


Fig.8

4. Refer to Table 5 about Functions and Service Data of AT24C08's Pins.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)**LA7840 (N301)****Vertical Deflection Output Circuit****1. Features**

- Low power dissipation due to built-in pump-up circuit
- Vertical output circuit
- Thermal protection circuit built in
- Excellent crossover characteristics
- DC coupling possible

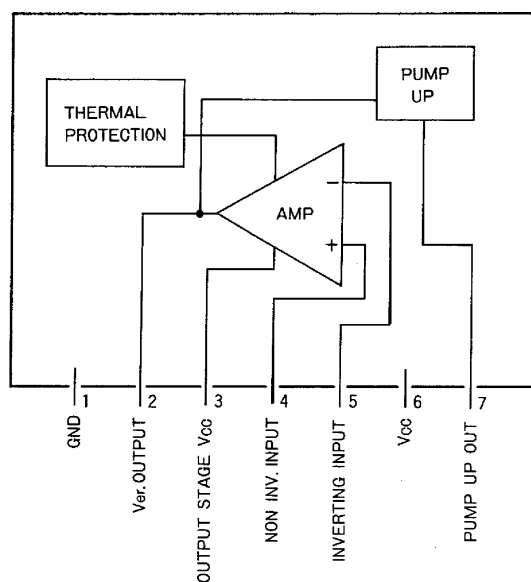
2. Block Diagram

Fig.9

3. Refer to Table 6 about Functions and Service Data of LA7840's Pins.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)**M52470AP (NS181)****4-Input 3-Channel Analog Switch****1. Description**

The M52470AP is a semiconductor integrated circuit containing an analog switch designed for use in a video system. It contains two audio switches and one video switch. Each switch has four inputs and can be independently controlled. In addition, the video switch contains an amplifier with a gain of about 7.0 dB.

2. Features

- Video and stereo sound switches in one package
- Wide frequency range(video switch).....DC~10MHz
- High separation(video)

.....Crosstalk 60dB (typ.)(@ 5MHz)

3. Application

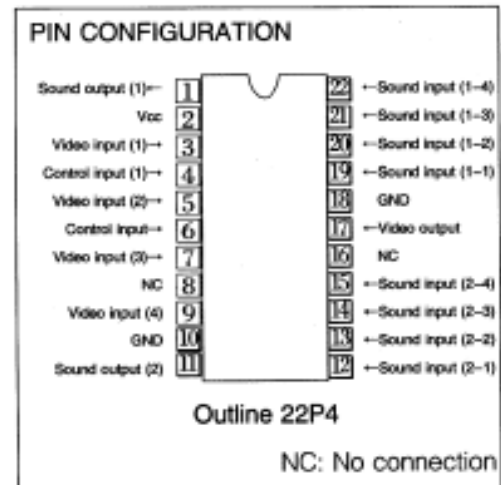
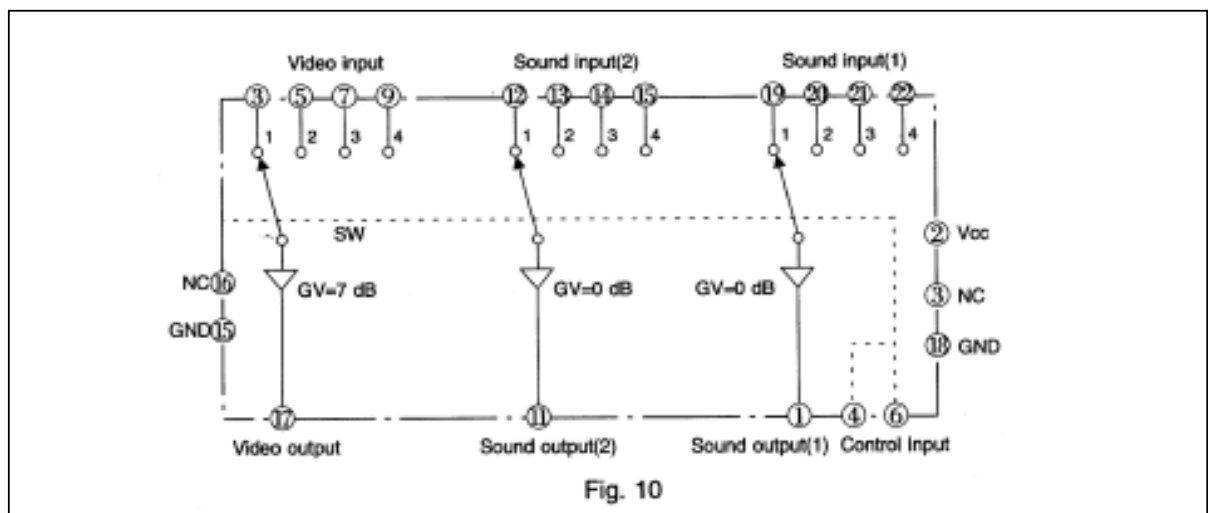
Video equipment.

4. Recommended Operating Conditions

Supply voltage range.....5~14V

5. Switch Mode Versus Control Input

S	W	②PIN	⑥PIN
1		GND	GND
2		GND	Vcc
3		Vcc	GND
4		Vcc	Vcc

**6. Block Diagram**

7. Refer to Table 7 about Functions and Service Data of M52470AP' s Pins.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)**Table 2 Functions and Service Data of LA76814 (N101)'s Pins**

Pin No.	Function Description	GDM8145 Multimeter		
		Voltage of Pin (V)	Ground Resistance (K Ω)	
			Measure with red probe while grounding black probe.	Measure with black probe while grounding red probe.
1	Audio output terminal	2.3	6.75	6.3
2	FM demodulation audio output	2.2	6.4	6.55
3	IF AGC filter	2.6	7.0	6.59
4	RF AGC output	1.6	∞	6.42
5	IF signal input	2.8	6.65	6.51
6	IF signal input	2.8	6.7	6.49
7	IF circuit ground	0	0	0
8	Supply voltage of IF circuit	5	0.37	0.35
9	DC loop filter of FM demodulator	2.6	1.25	6.57
10	AFT output	2.6	5.3	5.23
11	Data line	4.8	11.5	5.3
12	Clock line	4.8	11.5	5.4
13	ABL control input terminal	3.9	5.32	5.13
14	R character input	1.2	7.1	6.5
15	G character input	1.3	7.0	6.5
16	B character input	1.3	7.0	6.5
17	Fast blanking signal input	0	3.3	3.3
18	Supply voltage of RGB circuit	8	0.4	0.4
19	R signal output	2.3	5.5	6.3
20	G signal output	2.3	5.5	6.3
21	B signal output	2.3	5.5	6.3
22	B.AKB control voltage input terminal	0	7.39	6.39
23	Field sawtooth output	2.4	2.29	2.29
24	Vertical ALC control filter	2.6	7.08	6.47
25	Supply voltage of horizontal scanner/bus interface circuit	5.1	0.49	0.48
26	Horizontal AFC filter	2.7	7.22	6.52
27	Horizontal frequency pulse output	0.7	1.39	1.39
28	Horizontal flyback pulse input	1.0	6.83	6.36
29	Resistance resulted from external reference current	1.7	4.68	4.68
30	Not connected	0	∞	∞

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

31	Not connected	0	∞	∞
32	OSD gain control	2.5	0.59	0.59
33	Deflection circuit ground	0	0	0
34	X-ray detector filter	0	6.46	6.09
35	Killer filter	0.3	7.06	6.6
36	APC filter of sub-carrier restorer	3.4	6.95	6.46
37	3.58 MHz sub-carrier signal output terminal	2.4	7.32	6.56
38	External 3.58MHz crystal oscillator	2.8	7.14	6.59
39	ACC circuit filter	3.2	7.19	6.44
40	Selectable video signal output	2.2	1.0	1.0
41	Video/chroma/deflection circuit ground	0	0	0
42	External video signal input/S-Video luminance signal input	2.6	7.2	6.55
43	Supply voltage for video/chroma/deflection circuit	4.9	0.35	0.35
44	Internal video signal input/S-Video chroma signal input	2.7	7.22	6.46
45	Black level detecting filter of black level stretcher	3.1	6.89	6.43
46	Video output terminal	2.1	0.71	0.71
47	PLL APC filter of video detector	3.7	7.19	6.5
48	PLL VCO coil of video detector	4.3	0.88	0.88
49	PLL VCO coil of video detector	4.3	0.88	0.88
50	PLL APC filter 2 of video detector	2.4	7.0	6.26
51	External audio signal input	2.2	7.27	6.65
52	Second SIF signal output	2.0	7.29	6.33
53	Second APC filter	2.3	7.15	6.43
54	Second SIF signal input	3.1	7.35	6.58

IC DATA AND WAVEFORMS OF KEY POINTS (continued)**Table 3 Functions and Service Data of TDA7057AQ (N181)'s Pins**

Pin No.	Function Description	GDM8145 Multimeter		
		Voltage of Pin (V)	Ground Resistance (K Ω)	
			Measure with red probe while grounding black probe.	Measure with black probe while grounding red probe.
1	DC volume control 1	0~1.0	14.5	5.02
2	Not connected	0	∞	∞
3	Audio input terminal 1	2.4	∞	6.48
4	Supply voltage	14.7	12.5	4.36
5	Audio input terminal 2	2.4	∞	6.48
6	Pre-amplifier ground	0	0	0
7	DC volume control 2	0~1.0	14.5	5.02
8	Audio signal output terminal 2 (+)	7.5~5.8	12.87	4.6
9	Power amplifier 2 ground	0	0	0
10	Audio signal output terminal 2 (-)	7.5~5.8	12.87	4.6
11	Audio signal output terminal 1 (-)	7.5~5.8	13.12	4.76
12	Power amplifier 1 ground	0	0	0
13	Audio signal output terminal 1 (+)	7.5~5.8	13.12	4.76

Table 4 Functions and Service Data of LC86F3248A (D701)'s Pins

Pin No.	Function Description	GDM8145 Multimeter		
		Voltage of Pin (V)	Ground Resistance (K Ω)	
			Measure with red probe while grounding black probe.	Measure with black probe while grounding red probe.
1	Bass control output	5	12.28	5.1
2	Mute control output terminal (effective with high level)	0	11.36	4.49
3	Not connected	0	12.69	5.27
4	SECAM identification (ground)	0	0	0
5	Volume control output	0~1.0	3.4	3.3
6	Not connected	0	12.7	5.25
7	Standby/Power-on control	5/0	10.1	5.25
8	Not connected	5.2	12.75	5.25
9	Ground	0	0	0
10	Clock oscillation signal input terminal	2.4	12.7	5.6
11	Clock oscillation signal output terminal	2.8	12.6	5.61

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12	Supply voltage terminal	5.1	6.7	4.02
13	Button-control voltage input terminal	0	7.5	5.0
14	AFT voltage input terminal	2.3	5.4	5.23
15	Ground	0	0	0
16	Button-control voltage input terminal	0	7.7	5
17	Reset terminal	5	4.69	4.46
18	Filter	2.8	12.27	5.21
19	Video signal input terminal	3	12.47	5.62
20	Vertical flyback pulse input terminal	4.9	16.8	5.1
21	Horizontal flyback pulse input terminal	4.3	16.7	5.09
22	R character output terminal	0	6.7	5.04
23	G character output terminal	0	6.7	5.01
24	B character output terminal	0	6.7	5.04
25	Fast blanking signal output terminal	0	5.95	4.88
26	Not connected	0	12.6	5.48
27	Not connected	0	12.6	5.23
28	Not connected	0	12.6	5.3
29	Data line	4.8	11.3	5.16
30	Clock line	4.8	11.3	5.16
31	Input terminal of overload detector	5	12.7	5.45
32	Selectable production mode input terminal (effective with low level)	5	11.3	5.05
33	Auto white balance signal output terminal	1.9	12.7	5.27
34	Remote signal input terminal	5	12.6	5.2
35	SIF switchover output terminal (Not connected)	1.8	12.7	5.25
36	Not connected	0	12.7	5.25
37	TV/Video control output terminal	5	6.9	5.02
38	TV/Video control output terminal	5	6.9	5.02
39	Not connected	0	12.7	5.24
40	Not connected	0	12.7	5.25
41	Clock line 1	4.8	7.9	4.96
42	Data line 1	4.8	7.9	4.99

IC DATA AND WAVEFORMS OF KEY POINTS (continued)**Table 5 Function and Service Data of AT24C08 (D702)'s Pins**

Pin No.	Function Description	Digital Multimeter: Victor DT890D		
		Reference Voltage (V)	Positive Resistance (K Ω)	Negative Resistance (K Ω)
1	Address terminal 0	0	0	0
2	Address terminal 1	0	0	0
3	Address terminal 2	0	0	0
4	Ground	0	0	0
5	Data line	4.8	11.7	5.25
6	Clock line	4.8	11.72	5.5
7	Write-in/read-out control terminal	0	0	0
8	Supply voltage	5	6.7	4

Table 6 Functions and Service Data of LA7840 (N301)' s Pins

Pin No.	Function Description	GDM8145 Multimeter		
		Voltage of Pin (V)	Ground Resistance (K Ω)	
			Measure with red probe while grounding black probe.	Measure with black probe while grounding red probe.
1	Ground	0	0	0
2	Vertical output terminal	11.1	0.5	0.5
3	Pump supply voltage input	24.1	∞	∞
4	In-phase input terminal	2.2	1.28	1.28
5	Inverting input terminal	2.2	4.56	4.55
6	Supply voltage	24	1.49	1.49
7	Pump supply voltage output/vertical flyback pulse output	2.0	7.15	5.9

Table 7 Functions and Service Data of M52470AP (MS181)'s Pins

Pin No.	Function Description	GDM8145 Multimeter			
		Voltage of Pin (V)		Ground Resistance (K Ω)	
				Measure with red probe while grounding black probe.	Measure with black probe while grounding red probe.
1	Audio signal output terminal 1	4.4	4.4	∞	∞
2	Supply voltage	9.4	9.4	0.35	0.35
3	Video signal input terminal 1	3.5	3.5	7.46	6.22
4	Control level input terminal	5.2	5.2	6.88	5.03
5	Video signal input terminal 2	3.5	3.5	7.36	6.21

SERVICE MANUAL

(Continued)

6	Control level input terminal	5.0	5.0	6.85	5.0
7	Video signal input terminal 3	3.5	3.5	7.38	6.22
8	Not connected	0	0	∞	∞
9	Video signal input terminal 4	3.5	3.5	7.47	6.2
10	Ground	0	0	0	0
11	Audio signal output terminal 2	4.4	4.4	∞	5.95
12	Audio signal input terminal 2-1	5	5	7.15	5.92
13	Audio signal input terminal 2-2	5	5	7.15	5.92
14	Audio signal input terminal 2-3	5	5	7.35	6.2
15	Audio signal input terminal 2-4	5	5	7.1	5.9
16	Not connected	0	0	∞	∞
17	Video signal output terminal	4.2	4.2	2.02	2.02
18	Ground	0	0	0	0
19	Audio signal input terminal 1-1	5	5	7.13	5.9
20	Audio signal input terminal 1-2	5	5	7.13	5.9
21	Audio signal input terminal 1-3	5	5	7.32	6.2
22	Audio signal input terminal 1-4	5	5	7.1	5.9

Table 8 Functions and Service Data of TDA7056B(N181)'s Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage (V)	Positive Resistance(K Ω)	Negative Resistance(K Ω)
1	Not connected	0	∞	∞
2	Positive supply Voltage	15.5	900	900
3	Voltage input	2.4	1130	500
4	Signal ground	0	0	0
5	DC Volume control	0.8	22	22
6	Positive output	7.4	560	40
7	Power ground	0	0	0
8	Negative output	7.4	560	40
9	Not connected	0	∞	∞

Each Electrode Voltage of Key Triodes

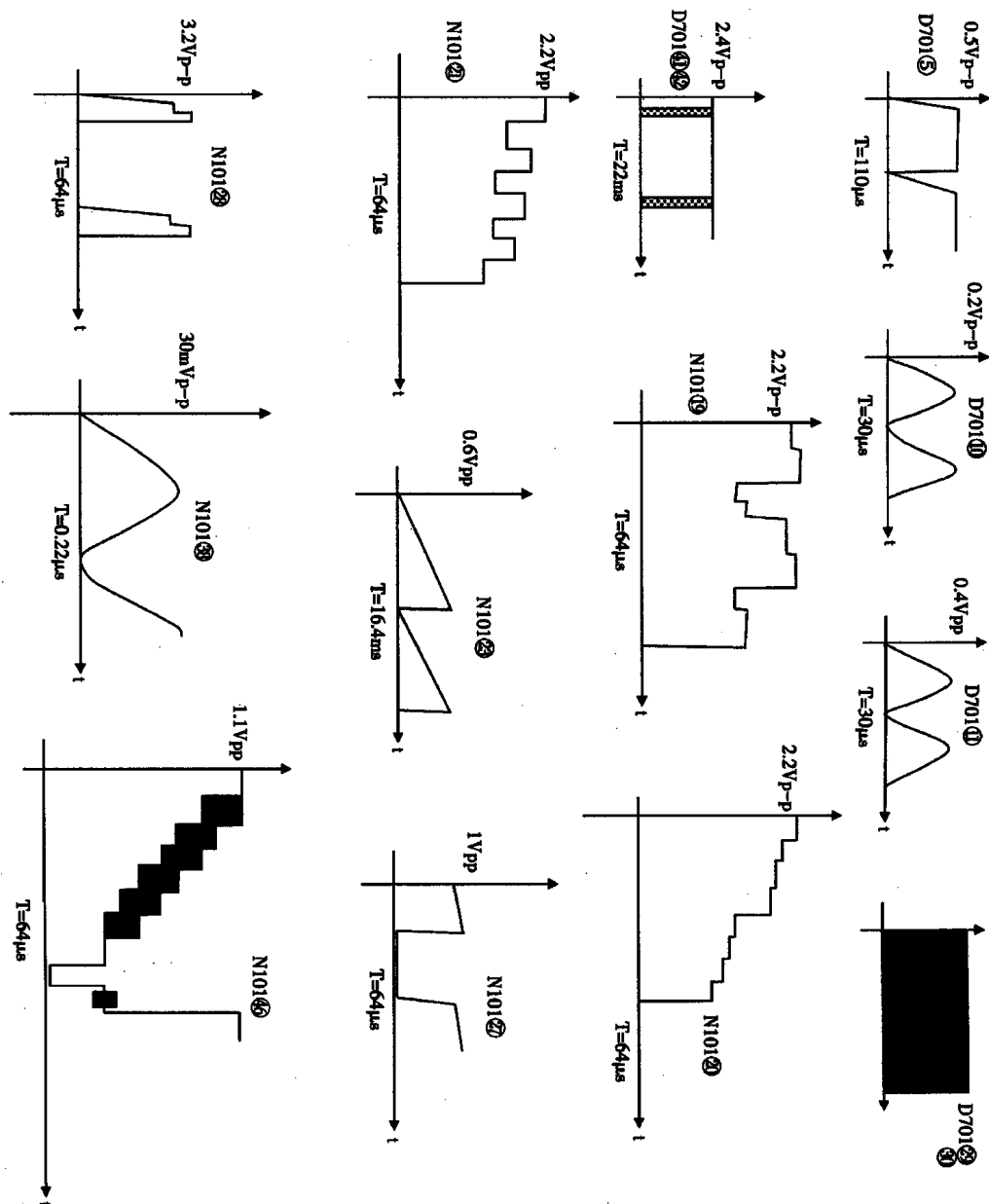
Position No. Electrode	V511	V512	V513	V553	V581	V582	V583	V702	V703	V704
B (V)	9.7	0.7	0.6	6.7	5.8	24.5	10	4.5	0	0.1
C (V)	0.7	0.6	170	34.5	2.4	23.9	12.5	5.1	4.5	4.9
E (V)	10	0	0	6.2	5.2	23.8	9.4	5.2	0	0

Position No. Electrode	V101	V231	VS812	VS814	V431	V432	V901	V902	V903	V904	V905	N503
B (V)	1.4	4.6	4.1	4.2	0.15	2.63	2.5	2.3	2.5	0	0.8	(1)9.3
C (V)	7.4	9.3	9.3	9.3	16.4	129.7	110	118	110	3.4	0	(2)5
E (V)	0.6	3.9	3.4	3.5	0	2.67	2.3	2.2	2.3	0.2	1.5	(3)0

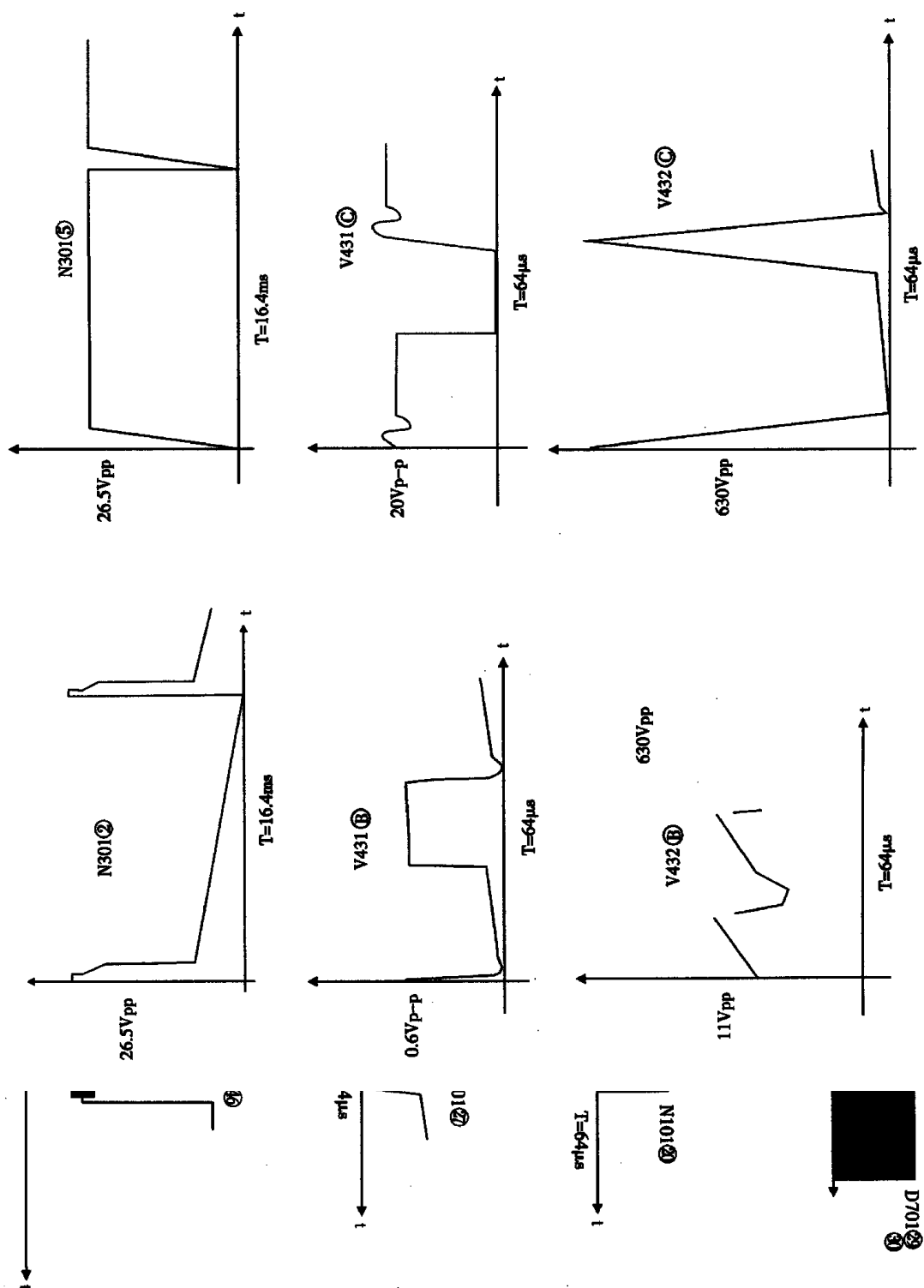
IC DATA AND WAVEFORMS OF KEY POINTS (continued)

Waveforms of Key Points

1. D701 (5) (10) (11) (29) (30) (41) (42)
2. N101 (19) (20) (21) (23) (27) (28) (38) (46)
3. N301 (5) (2)
4. V431(B) (C), V432 (B) (C)



IC DATA AND WAVEFORMS OF KEY POINTS (continued)



CIRCUIT ADJUSTMENTS

1. General Description

All adjustments are thoroughly checked and corrected before the TV outgoing. Therefore the TV should operate normally and deliver proper colour pictures upon installation. However, several minor adjustments may be required depending on the particular location where the TV is operated.

This TV is shipped completely in carton. Carefully take out the TV from the carton and remove all packing materials. Connect the power cord into a 120V AC, 60Hz two-pin power outlet. Turn on the TV. Check and adjust all the customer controls such as brightness, contrast and colour to obtain natural colour pictures.

2. Automatic Degaussing

A degaussing coil is mounted around the CRT so that external degaussing after moving the TV is generally unnecessary, providing it is properly degaussed upon installation. The degaussing coil operates in about 1 second after power on. If the set is moved or faced to a different direction, the power switch must be switched off for at least 30 minutes in order that the automatic degaussing circuit operates properly. Should the chassis or parts of the cabinet become magnetized to cause poor colour purity, use an external-degaussing coil. Slowly move the degaussing coil around the screen, the sides and front of the TV and slowly withdraw the coil to a distance of about 2m before unplug it. If colour shading still exists, perform the Colour Purity Adjustment and Convergence Adjustment procedures.

3. Supply Voltage Adjustment

Caution: +B voltage has close relation to high voltage. To avoid X-ray radiation, +B voltage should be +130V.

- 1) Set RP551 to the mechanical center and AC power supply to $120\pm 2V$.
- 2) Connect a digital voltmeter to two pins of C561, and then turn on the TV.
- 3) Receive Philips test pattern signals.
- 4) Adjust RV801 to make the voltmeter read $130\pm 1V$.

4. High Voltage Inspection

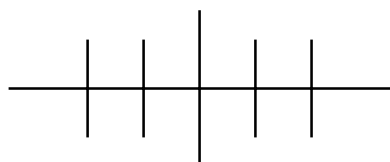
Caution: No high voltage adjustment should be done in the chassis.

- 1) Connect a precise high voltmeter to the second anode of the CRT.
- 2) Turn on the TV and set the brightness and contrast to minimum (i.e. set beam current of the CRT to zero).
- 3) The high voltage tested should be $25.5\pm 1.5KV$.
- 4) Set the brightness to minimum or maximum, and ensure high voltage not beyond limitation of 28KV in any case.

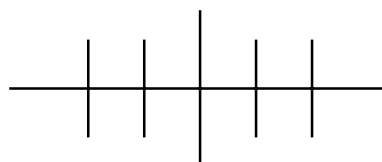
CIRCUIT ADJUSTMENTS(continued)

5. Focus Adjustment

- 1) Use the remote control to set the contrast to maximum and the brightness, chroma to medium.
- 2) Set H. V. lines near center of Philips pattern to thinnest with the FCB on the FBT. After finishing adjustment, ensure that no poor focusing exists near the center or around of the frame.



Before Adjusting



After Adjusting

SET-UP ADJUSTMENTS

- The following adjustments should be made when a complete realignment is required or a new CRT is installed. Perform the adjustments in order as follows.

1. Colour purity
2. Convergence
3. White Balance

Note:

The purity/convergence magnet assembly and rubber wedges need mechanical positioning. Refer to Fig. 11.

1. Colour Purity Adjustment

Note:

Before attempting any purity adjustment, the TV should be operated for at least 15 minutes.

- 1) Demagnetize the CRT and cabinet using a degaussing coil.
- 2) Set the brightness and contrast to maximum.
- 3) Receive the green raster test pattern.
- 4) Loosen the clamp screw holding the deflection yoke and slide it backward or forward to display vertical green belt (zone) on the screen.
- 5) Remove the rubber wedge.
- 6) Rotate and spread the tabs of the purity magnet around the neck of the CRT until the green belt is on the center of the screen.
- 7) Slowly move the deflection yoke forward or backward until a uniform green screen is obtained. Tighten the clamp screw of the yoke temporarily.
- 8) Check purity of the red and blue raster.

SET-UP ADJUSTMENTS(continued)

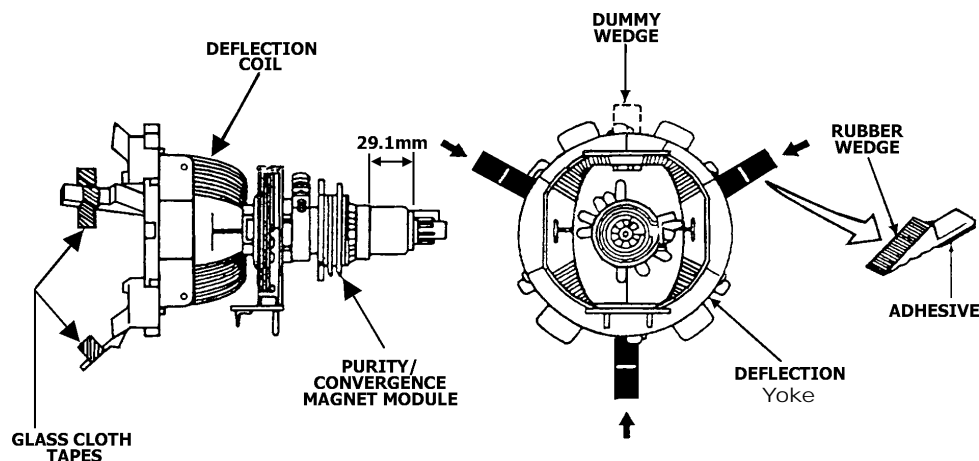


Fig. 11

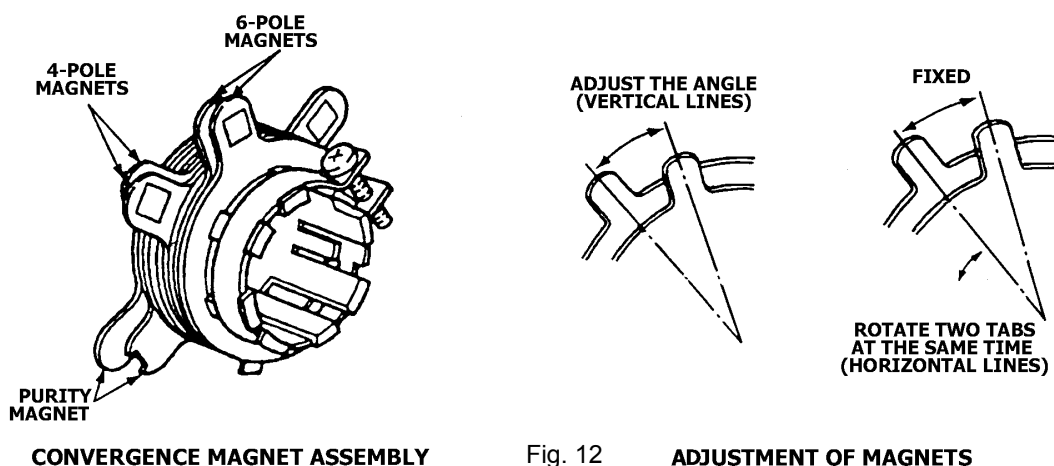


Fig. 12

2. Convergence Adjustment

Note:

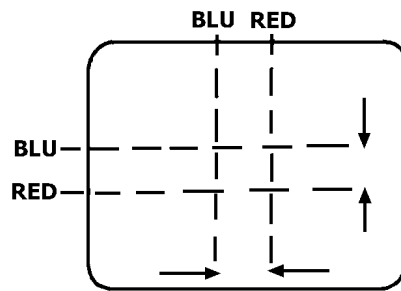
Before attempting any convergence adjustment, the TV should be operated for at least 15 minutes.

● Center convergence adjustment

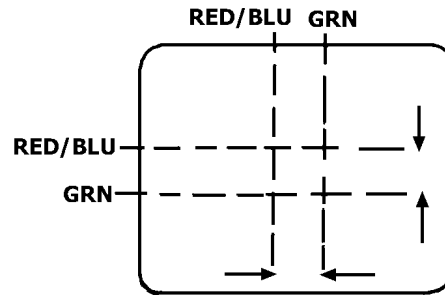
- 1) Receive the crosshatch test pattern.
- 2) Set the brightness and contrast properly.
- 3) Adjust two tabs of the 4-pole magnet to change the angle between them and red and blue vertical lines are superimposed on the center area of the screen.
- 4) Turn both tabs at the same time keeping the angle constant to superimpose red and blue horizontal lines on the center of the screen.
- 5) Adjust two tabs of 6-pole magnet to superimpose red/blue line and green line. Adjusting the angle affects the vertical lines and rotating both magnets affects the horizontal lines.
- 6) Repeat steps 3)~5) keeping in mind red, green and blue movement. 4-pole magnet and 6-pole magnet interact each other, resulting in complicating and dot movement.

● Circumference convergence adjustment

- 1) Loosen the clamping screw of the deflection yoke slightly to allow it to tilt.
- 2) Temporarily put a wedge as shown in Fig. 9. (Do not remove cover paper on adhesive part of the wedge.)
- 3) Tilt front of the deflection yoke up or down to obtain better convergence in circumference.
Push the mounted wedge into the space between the CRT and yoke to fix the yoke temporarily.
- 4) Put other wedge into bottom space and remove the cover paper to stick.
- 5) Tilt front of the deflection yoke right or left to obtain better convergence in circumference.
- 6) Keep the deflection yoke position and put another wedge in either upper space. Remove cover paper and stick the wedge on the CRT to fix the yoke.
- 7) Detach the temporarily mounted wedge and put it in another upper space. Stick it on the CRT to fix the yoke.
- 8) After fixing three wedges, recheck overall convergence.
Tighten the screw firmly to fix the yoke and check if the yoke is fixed.
- 9) Stick three adhesive tapes on wedges as shown in Fig. 9.

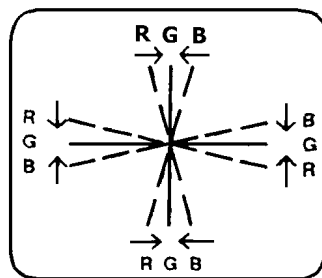


4-pole Magnet Movement

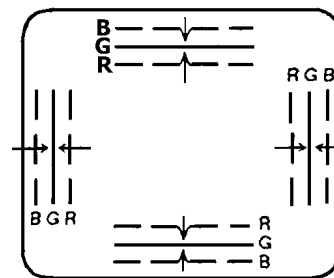


6-pole Magnet Movement

Center Convergence by Convergence Magnets



Incline the Yoke Up (or Down)




Incline the Yoke Right (or Left)

Circumference Convergence by DEF Yoke

Fig.13

SERVICE MODE AND BUS DATA

1. How to Enter the Service Mode with the Remote Control

- 1) Decrease volume to 0.
- 2) Press the MUTE button on the remote control and VIDEO button on the TV at the same time.
- 3) Adjust the TV with the MENU SELECT buttons on the remote control.
- 4) Press the  button on the remote control to quit the Service mode.

2. Bus Data

Item	Symbol Description	Bus Data
MENU.00		
V.POS /50H	VERTICAL POSITION /50Hz	39
H.PHSH /50H	HORIZONTAL PHASE /50Hz	9
V.SIZE /50H	VERTICAL SIZE /50Hz	78
V.POS /60H	VERTICAL POSITION /60Hz	32
V.PH /60H	HORIZONTAL PHASE /60Hz	12
V.SIZE /60H	VERTICAL SIZE /60Hz	93
V.SC	VERTICAL S-CORRECTION	4
V.LINE	VERTICAL LINE	18
V.SIZE CMP	VERTICAL SIZE COMPENSATION	7
MENU.01		
SUB.BIGHT	SUB-BRIGHT	63
SUB.CONT	SUB-CONTRAST	45
V.KILL	VERTICAL KILL	0
RF.AGC	RF AGC	15
R.BIAS	RED BIAS	60
G.BIAS	GREEN BIAS	120
B.BIAS	BLUE BIAS	60
R.DRIVE	RED DRIVE	90
G.DRIVE	GREEN DRIVE	15
B.DRIVE	BLUE DRIVE	90
MENU.02		
H.AFC GAIN	HORIZONTAL AFC GAIN	0
H.BLK.L	HORIZONTAL BLANKING LEFT	4
H.BLK.R	HORIZONTAL BLANKING RIGHT	3
CROS.B/W	CROSSHATCH BLACK/WHITE	0
VIDEO.LVL	VIDEO LEVEL	4
FM.LEVEL	FM LEVEL	16
MENU.03		
FM.MUTE	FM MUTE	0
AUD.MUTE	AUDIO MUTE	0
VIDEO.MUTE	VIDEO MUTE	0
SND.TRAP	SOUND TRAP	0
MENU.04		
SUB.COLOR	SUB COLOR	31
SUB.TINT	SUB TINT	31
S.SHARP	SUB SHARP	32
CORING.	CORING GAIN	1

SERVICE MANUAL

C.EXT	EXTERNAL CHROMA	0
C.BYPASS	CHROMA BAND-PASS BYPASS	0
C.KILL ON	COLOR KILL ON	0
MENU.05		
BLANK.DEF	BLANK DEFEAT	0
BLK.ST.DEF		0
FBP.BLK.SW	FLYBACK PULSES (HORIZONTAL) BLANKING SWITCH	0
FILT.SYS	FILTER SYSTEM: SELECT Y/C FILTER MODE	0
VOL.FIL	VOLUME FILTER	0
VIF.SYS	VIF SYSTEM	0
VIDEO.SW	VIDEO SWITCH	0
MENU.06		
R/B ANGLE	R-Y/B-Y ANGLE	9
GREY MODE	GREY MODE	0
V.SETUP	VERTICAL SETUP	1
B.GAM.SEL		3
RG.GAM.DEF		1
MENU.07		
BRT.ABL.TH	BRIGHT ABL THRESHOLD	7
EM.ABL.DEF		0
BRT.ABL.DF	BRIGHT ABL DEFEAT	1
MID.STP.DF	BRIGHT MID STOP DEFEAT	1
MENU.08		
DIGITAL.OSD	DIGITAL OSD MODE	0
OSD.CONT	OSD CONTRAST CONTROL	1
OSD.H.POS	OSD HORIZONTAL POSITION	22
MENU.09		
H.FREQ	HORIZONTAL FREQUENCY	27
C.KILL.OFF	COLOR KILL OFF	0
AUDIO.SW	AUDIO SWITCH	0
T.DISBLE	TEST MODE SWITCH DISABLE	1
MENU.10		
OPT.TV.AV	OPTION TV/AV	1
OPT.COLOR	OPTION COLOR	0
OPT.V-CHIP	OPTION V-CHIP	1
OPT.CCD	OPTION CCD	1
OPT.CLOCK	OPTION CLOCK	1
OPT.P-ON	OPTION P-ON	0
SRCH.SPEED	SEARCH SPEED	0
ROM.CORREC	ROM CORRECTION	0

Notes:

- ① The data sheet may differ dependent on different models.
- ② The data sheet may differ dependent on different CRTs for the same model.

3. Service Mode Adjustment

- 1) Sub-brightness
- a) Receive colour signals.

b) Set the contrast to maximum and brightness to medium.

c) Set the chroma to medium.

Enter the TV to the Service mode. Select "SUB-BRIGHT" by pressing the \leftarrow/\rightarrow buttons on the remote control, and set the data to 31 by pressing the data adjustment buttons. Operate the TV for 5 minutes in the mode.

d) Adjust the sub-bright data until blurry picture does not appear on the high bright area of the screen and too dim picture not on the low-bright area.

e) Set the contrast and brightness to maximum or minimum, and then test normal picture alternation.

f) If the picture does not become dark when the contrast and brightness are set to minimum, or not become bright when set to maximum, then adjust the sub-bright data to get normal picture.

2) White balance adjustment

a) Turn on the TV and preheat it for over 7 minutes.

b) Use the remote control to set the contrast to maximum and the brightness to medium. Set the chroma to minimum.

c) Enter the TV to the Service mode, and set the following data without changing other items.

R-DRIVE.....70

G-DRIVE.....15

B-DRIVE.....70

d) Pull out the external antenna and press the MUTE button once on the remote control until a right horizontal line appears on the screen. Adjust the R-DRV data to get $160V \pm 0.5$ green gun voltage across the CRT RGB PCB.

e) Adjust the G-DRV and B-DRV data according to Step 4 so that the bright horizontal line turns to yellow, then to white.

3) Horizontal centering adjustment

Enter the TV to the Service mode and receive Philips test pattern. Select "H.PH/60H" by pressing the \leftarrow/\rightarrow buttons on the remote control, and adjust horizontal picture position in the center of screen by pressing the data adjustment buttons.

4) Vertical centering adjustment

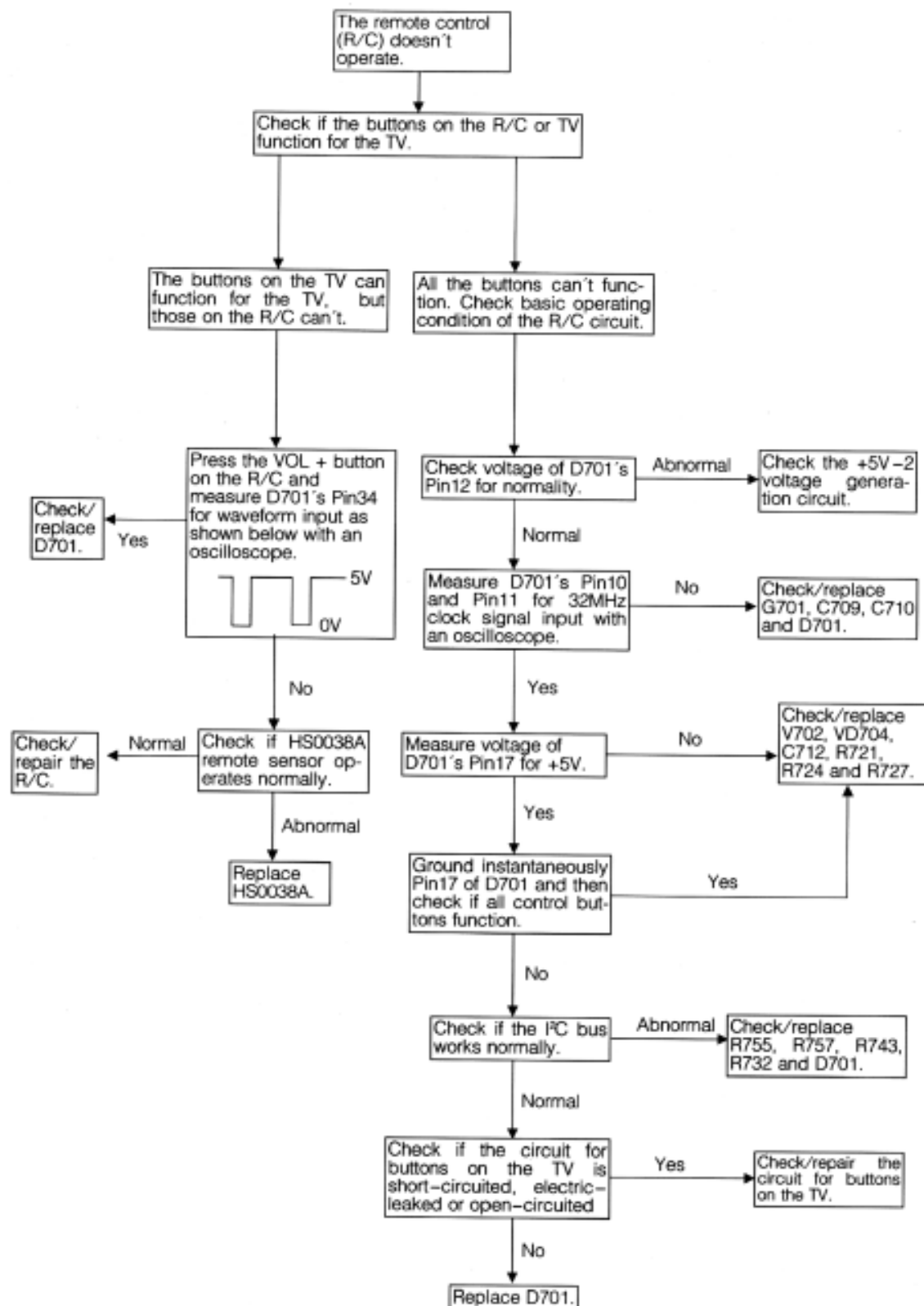
Enter the TV to the Service mode and receive Philips test pattern. Select "V.POS/60H" by pressing the \leftarrow/\rightarrow buttons on the remote control, and adjust vertical picture position in the center of screen by pressing the data adjustment buttons.

5) Vertical amplitude adjustment

Enter the TV to the Service mode and receive crosshatch test pattern. Select "V.SIZE" by pressing the \leftarrow/\rightarrow buttons on the remote control, and adjust vertical amplitude by pressing the data adjustment buttons so that vertical amplitude is not enough. Continue to adjust vertical amplitude by pressing the data adjustment button until the first bar on the pattern touches edge of the screen.

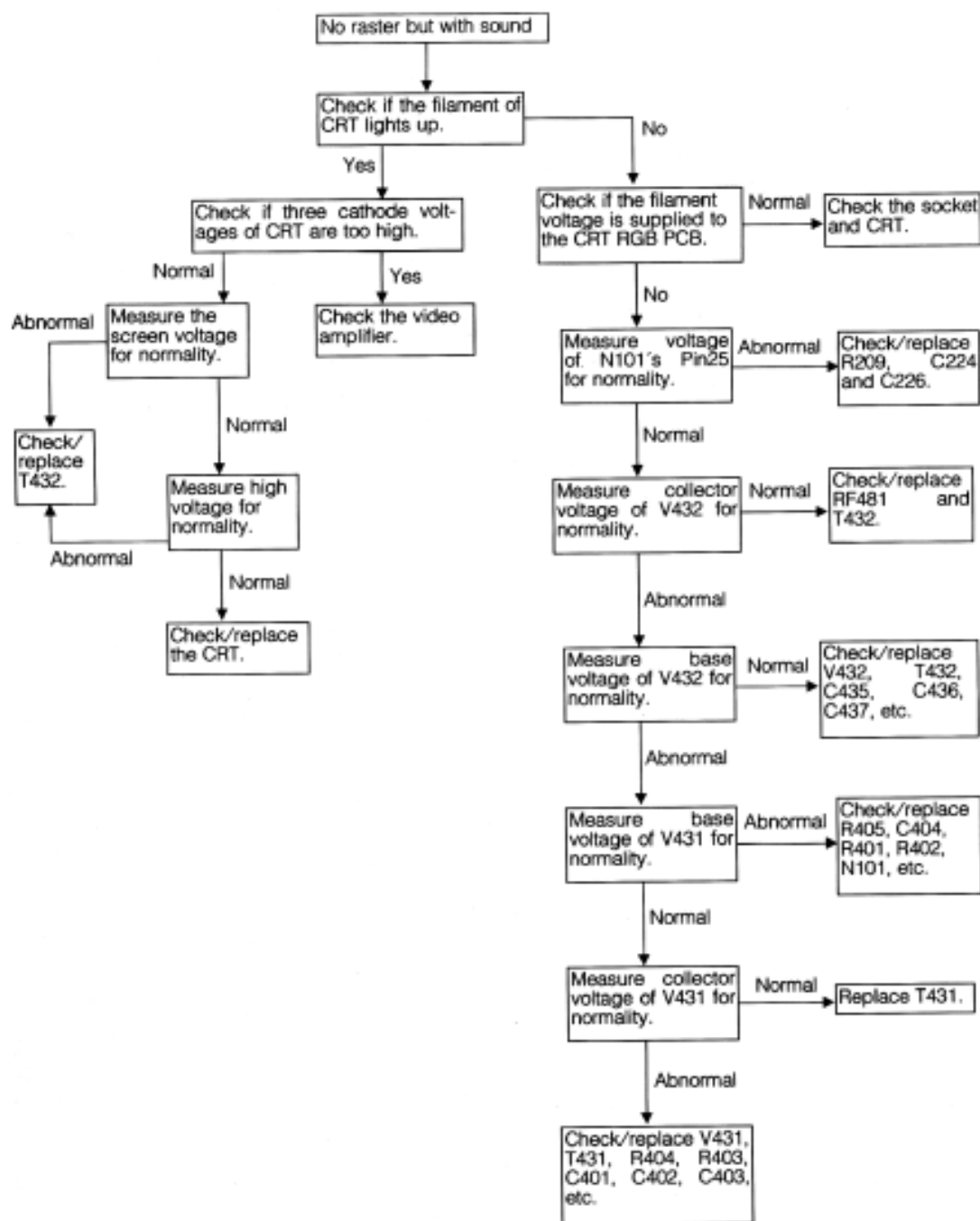
TROUBLESHOOTING FLOW CHARTS

1. The remote control doesn't operate



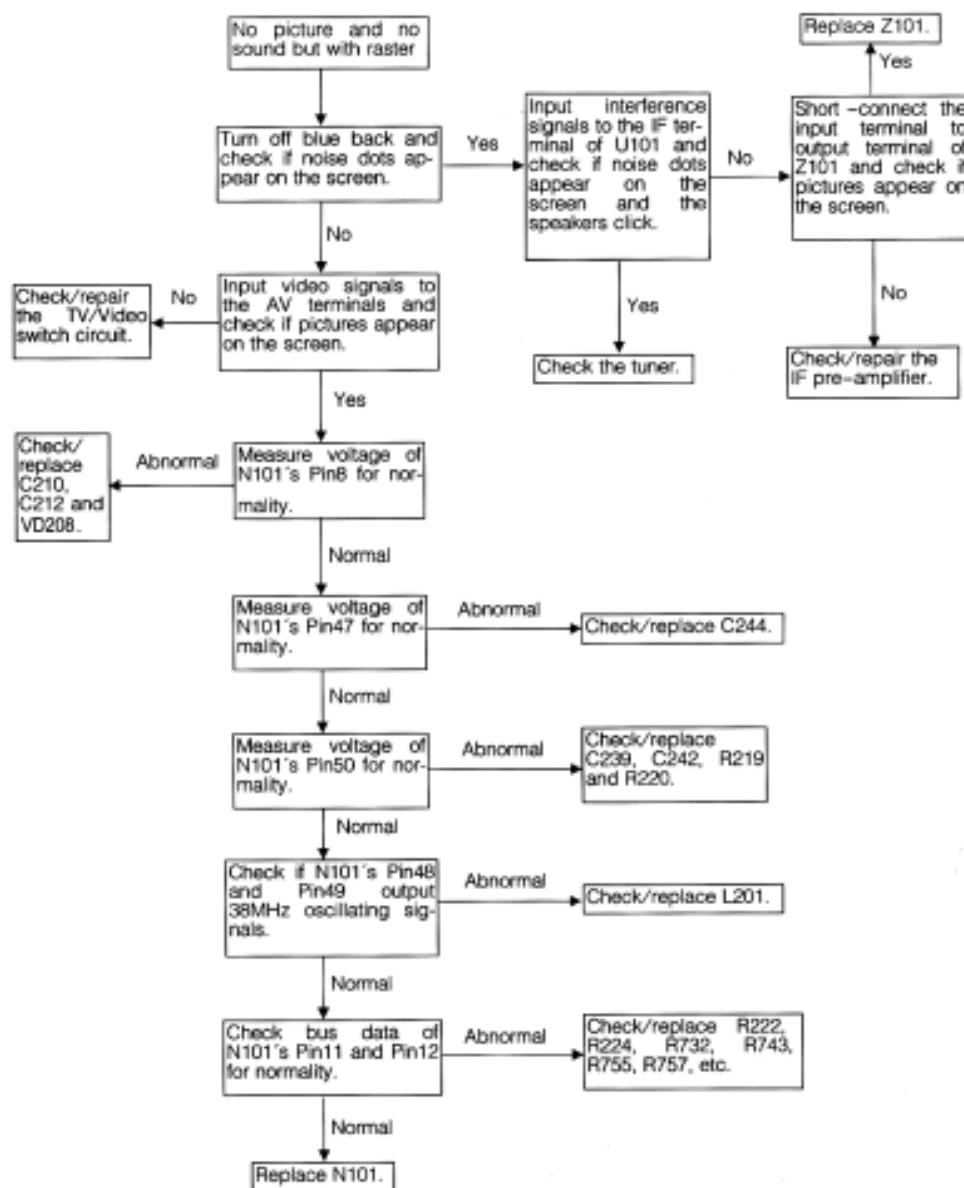
TROUBLESHOOTING FLOW CHARTS(continued)

2. No raster but with sound



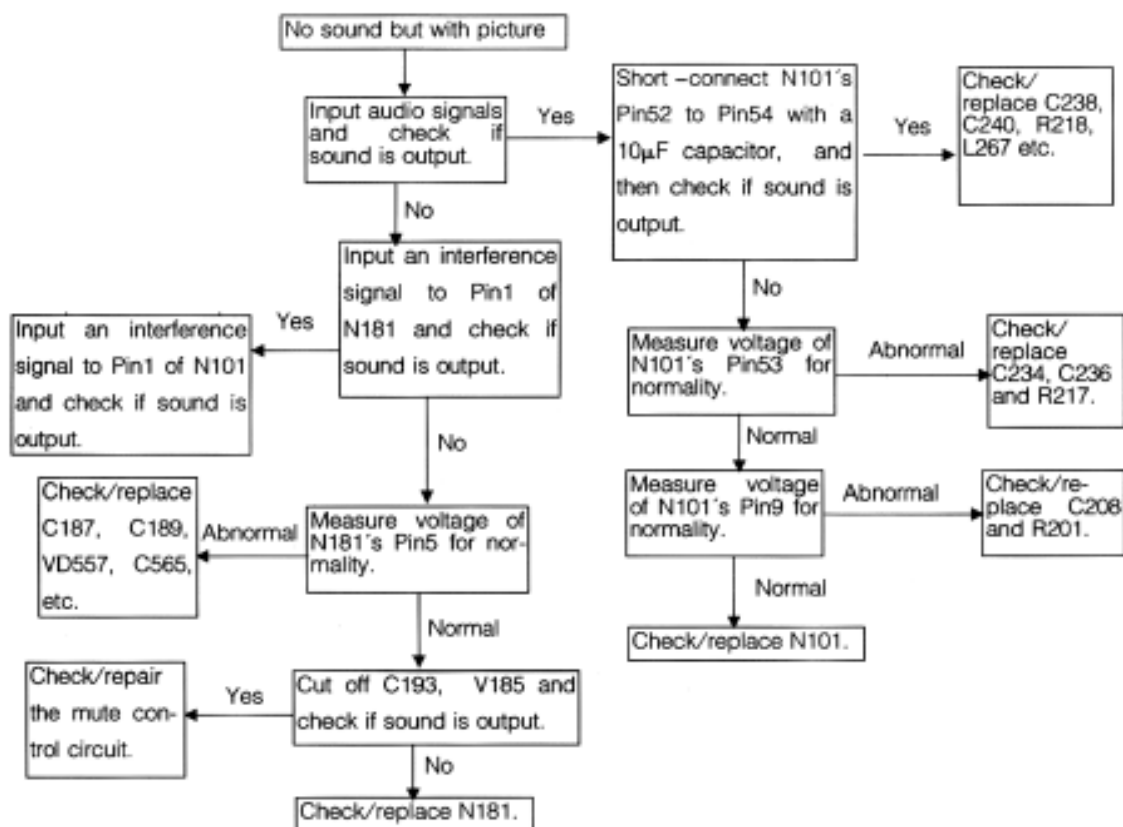
TROUBLESHOOTING FLOW CHARTS(continued)

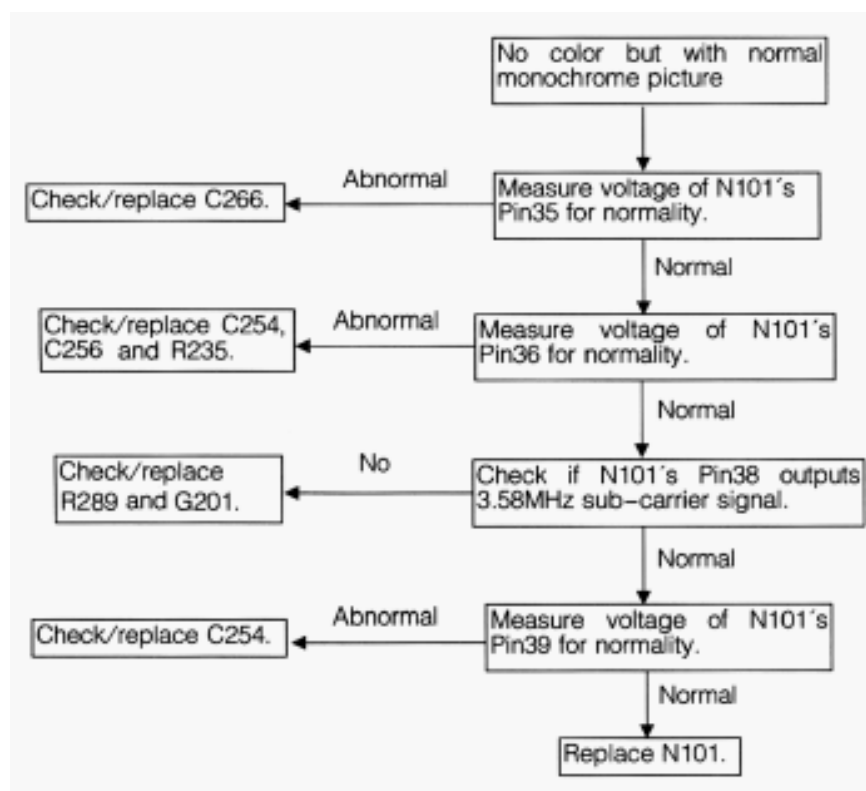
3. No picture and no sound but with raster



TROUBLESHOOTING FLOW CHARTS(continued)

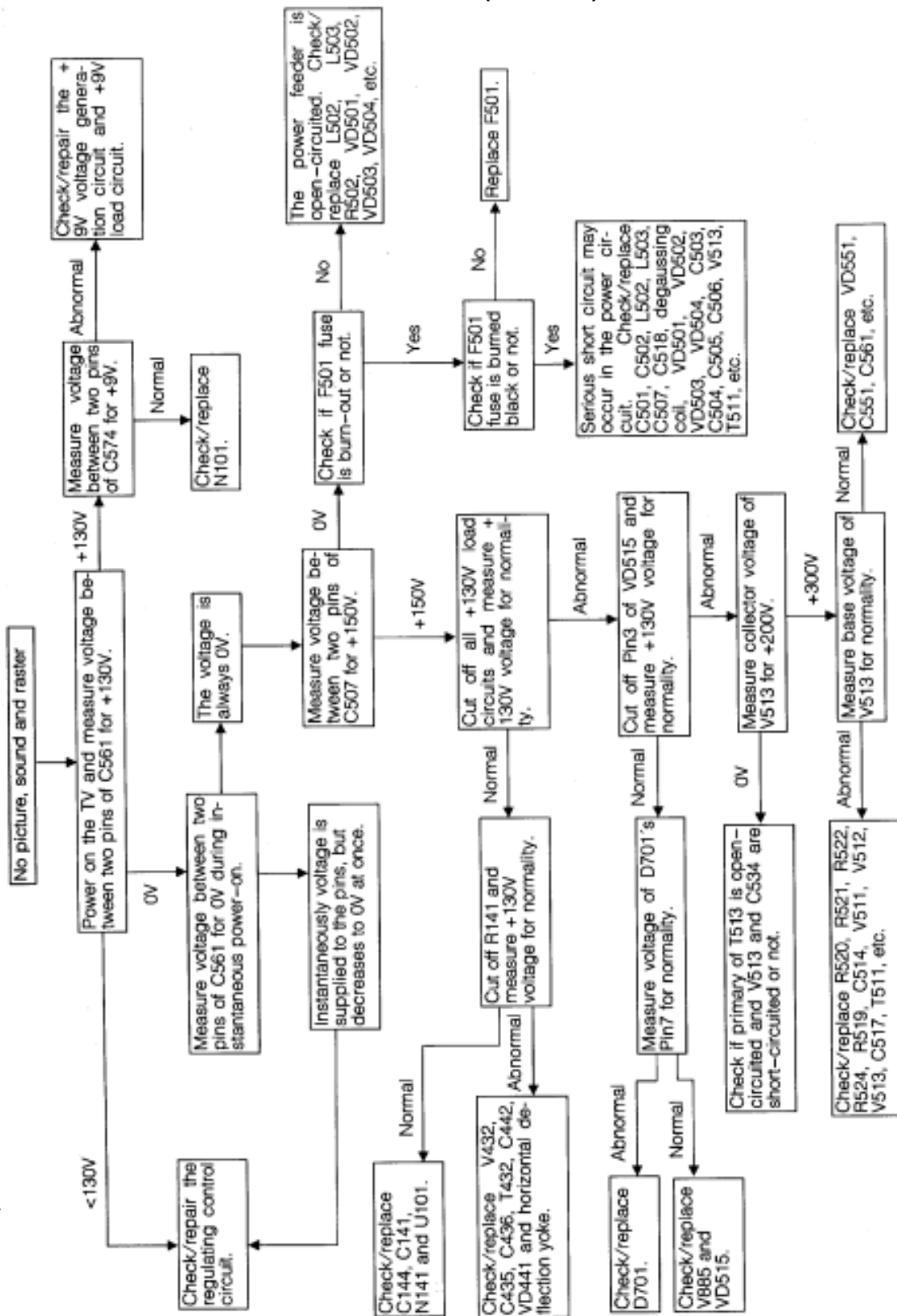
4. No sound but with picture



TROUBLESHOOTING FLOW CHARTS(continued)**5. No color but with normal monochrome picture**

TROUBLESHOOTING FLOW CHARTS(continued)

6. No picture, sound and raster

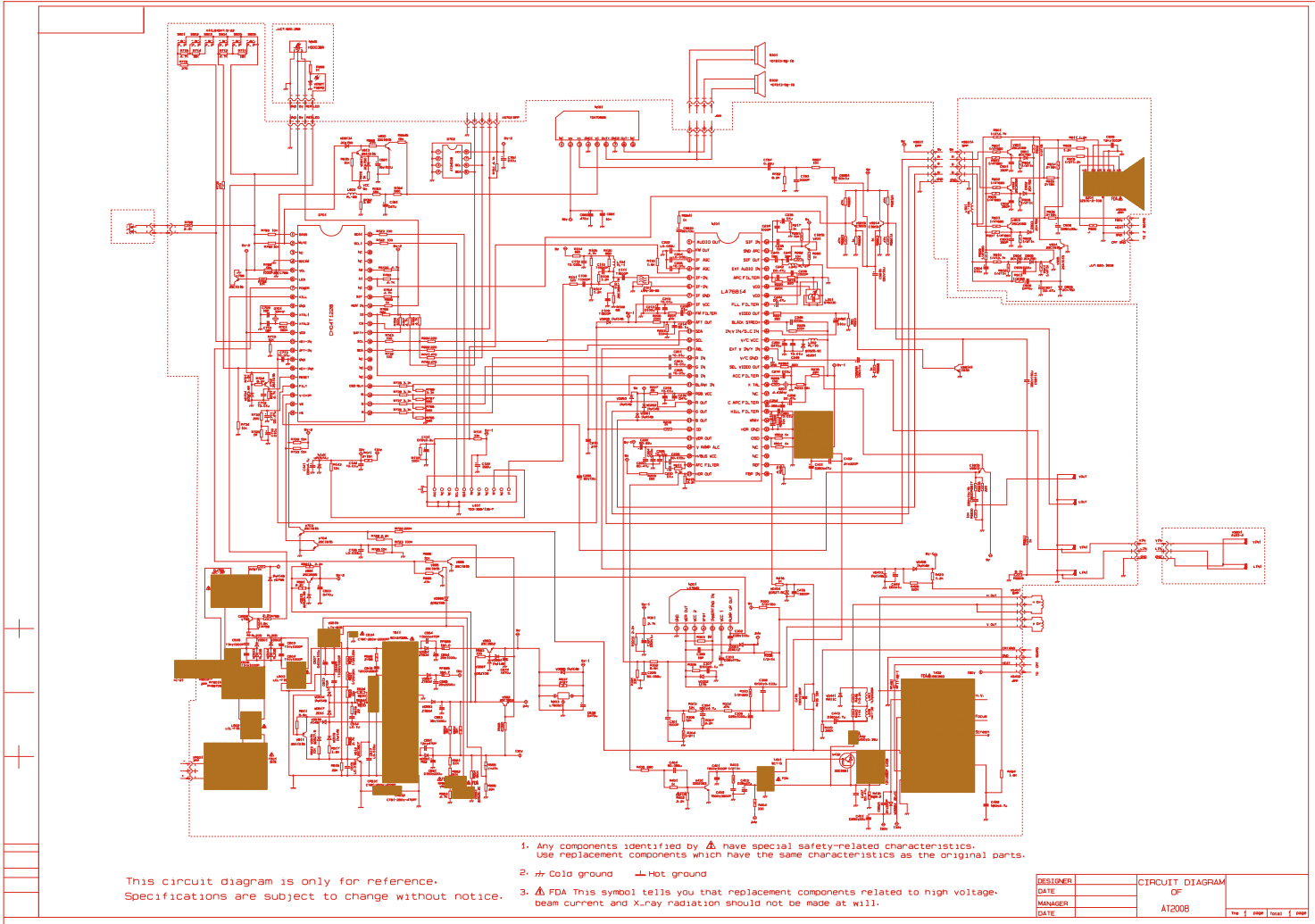


SERVICE SPARE PARTS LIST

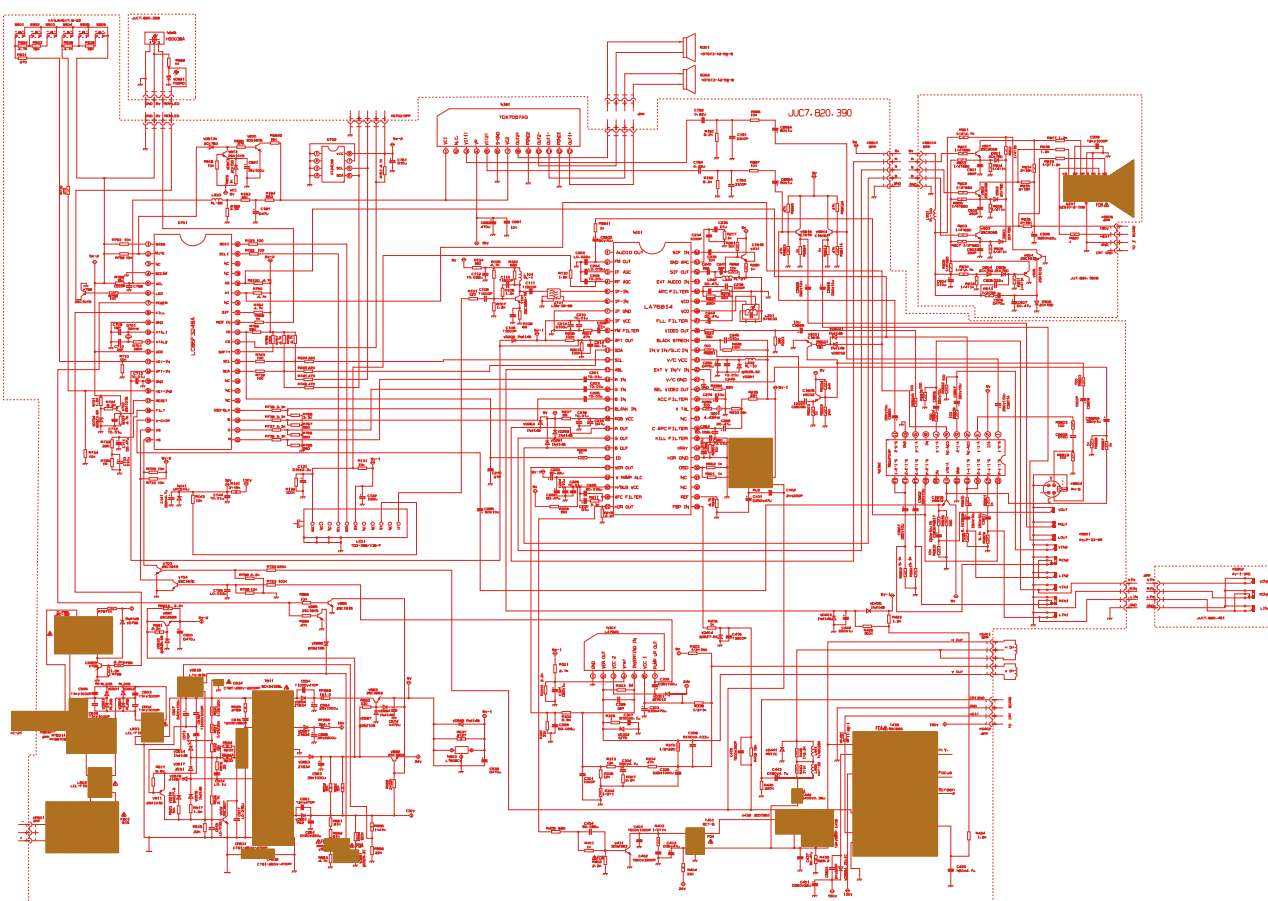
APPENDIX

1. CIRCUIT DIAGRAM
2. PRINTED CIRCUIT BOARD DIAGRAMS
3. FINAL ASSEMBLY DIAGRAM AND FINAL WIRING DIAGRAMS

APPENDIX 1: CIRCUIT DIAGRAM OF AT2008



APPENDIX 1: CIRCUIT DIAGRAM OF AT2008S

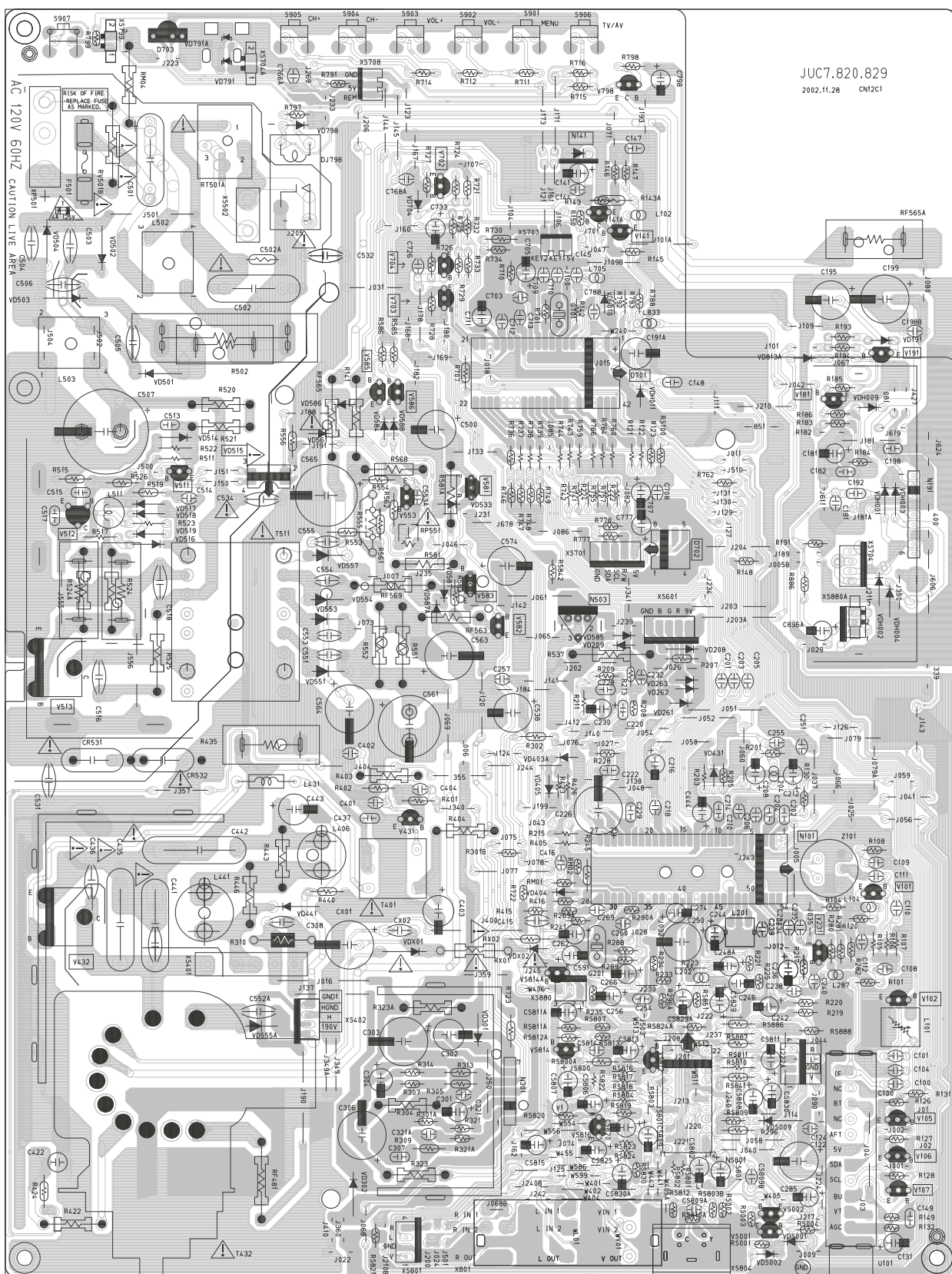


1. Any components identified by Δ have special safety-related characteristics. Use replacement components which have the same characteristics as the original parts.
2. --- Cold ground --- Hot ground
3. Δ FDA This symbol tells you that replacement components related to high voltage, beam current and X-ray radiation should not be made at will.

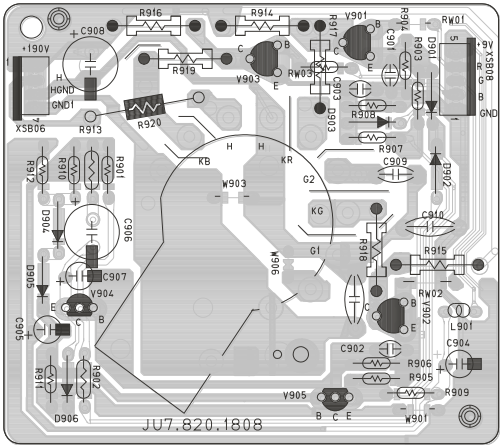
This circuit diagram is only for reference.
Specifications are subject to change without notice.

DESIGNER		CIRCUIT DIAGRAM OF AT2008S	
DATE			
MANAGER			
DATE			

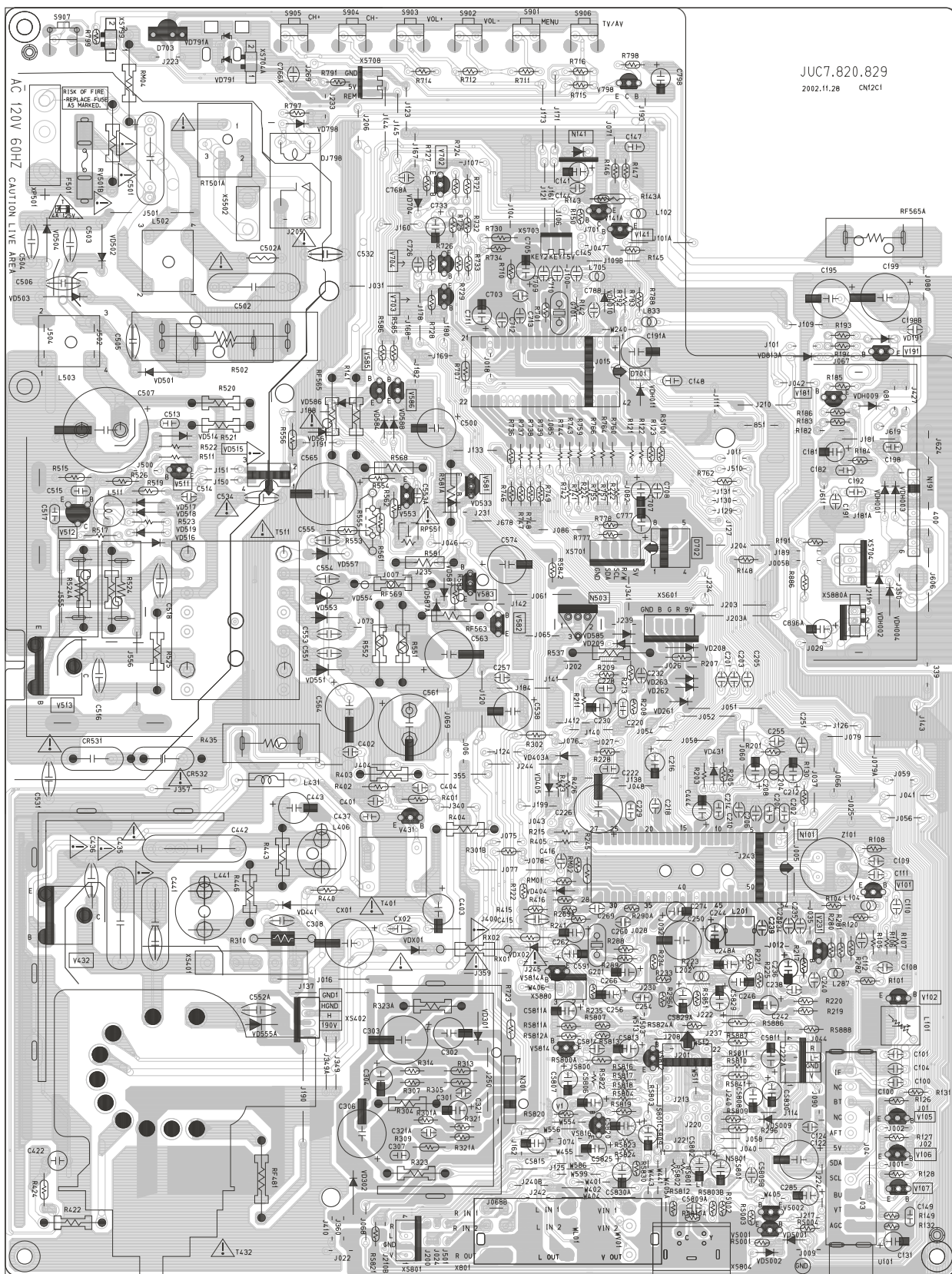
APPENDIX 2: MAIN PCB OF AT2008



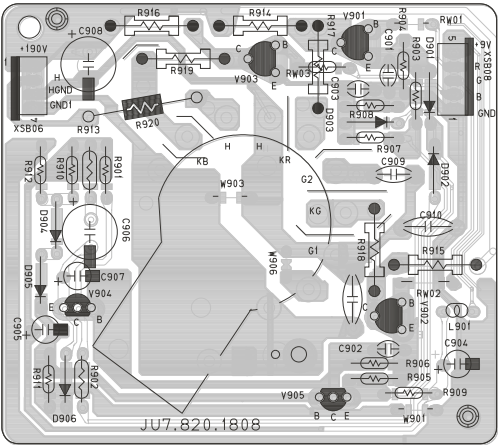
APPENDIX 2: CRT RGB PCB OF AT2008



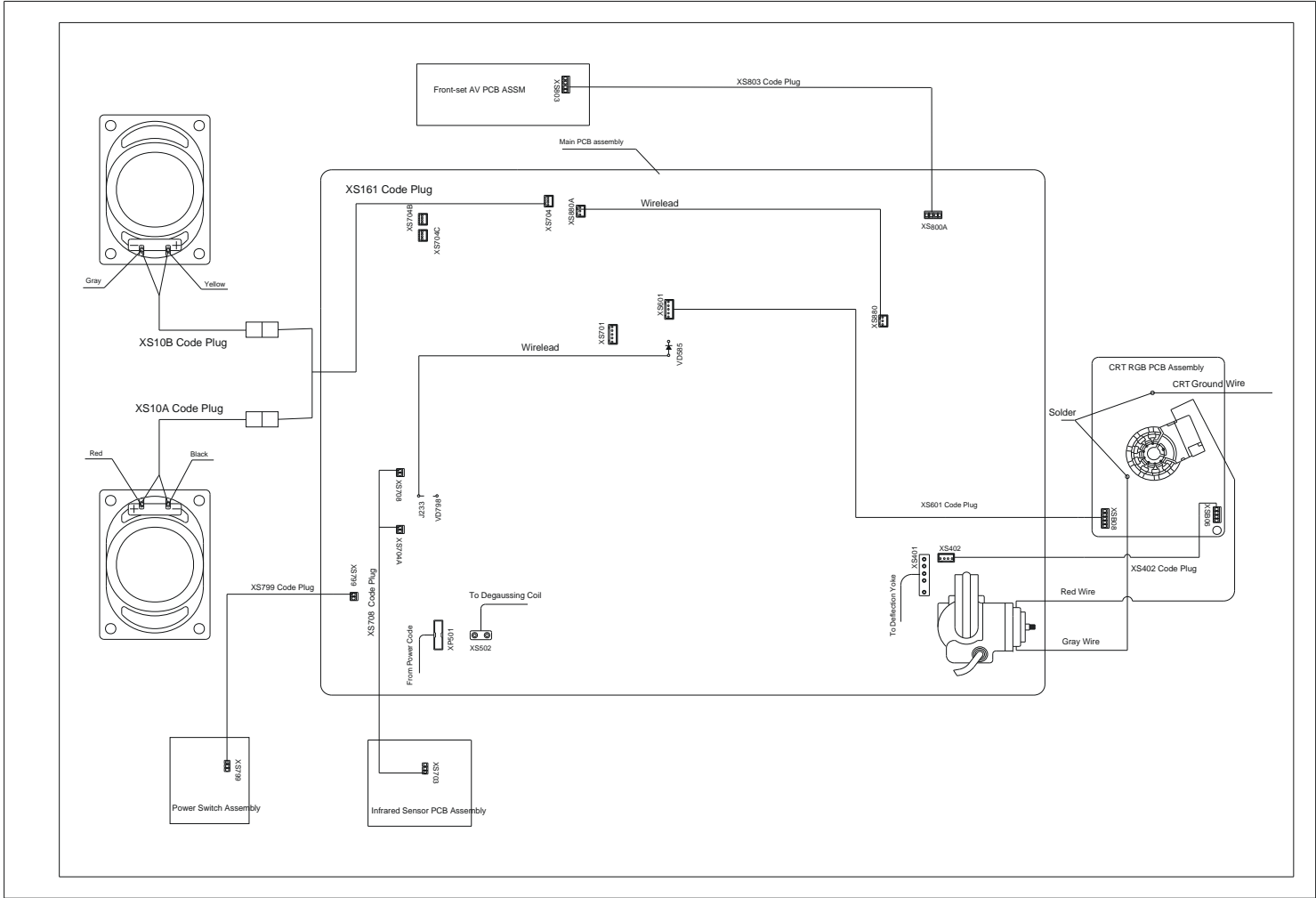
APPENDIX 2: MAIN PCB OF AT2008S



APPENDIX 2: CRT RGB PCB OF AT2008S



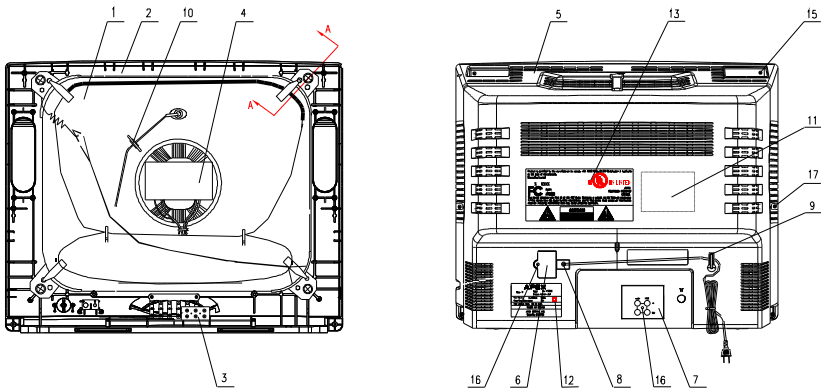
APPENDIX 3: FINAL WIRING DIAGRAM OF AT2008



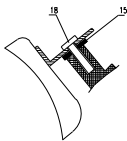
The diagram illustrates the internal wiring of a Philips television, showing the connection of various components and code plugs. Key components and connections include:

- Front-set AV PCB ASSM**: Connected to the **XS803 Code Plug**.
- Main PCB assembly**: The central hub for most connections.
- XS10B Code Plug** and **XS10A Code Plug**: Connected to the main PCB assembly via Gray and Yellow wires.
- XS799 Code Plug**: Connected to the main PCB assembly and the **Power Switch Assembly** (64J5X).
- XS161 Code Plug** and **XS880 Code Plug**: Connected to the main PCB assembly and the **XS800A** component.
- XS803 Code Plug**: Connected to the **Front-set AV PCB ASSM**.
- XS501 Code Plug**: Connected to the main PCB assembly and the **XS402 Code Plug**.
- XS402 Code Plug**: Connected to the main PCB assembly and the **CRT RGB PCB Assembly**.
- CRT RGB PCB Assembly**: Connected to the **CRT Ground Wire** and the **Solder** point.
- Deflection Yoke**: Connected to the **XS501 Code Plug** and the **XS402 Code Plug**.
- Degaussing Coil**: Connected to the **XS502** component and the **From Power Code** (XP501).
- Test Points**: J233, VD708, and VD586 are indicated for testing.

APPENDIX 4: FINAL DIAGRAM OF AT2008

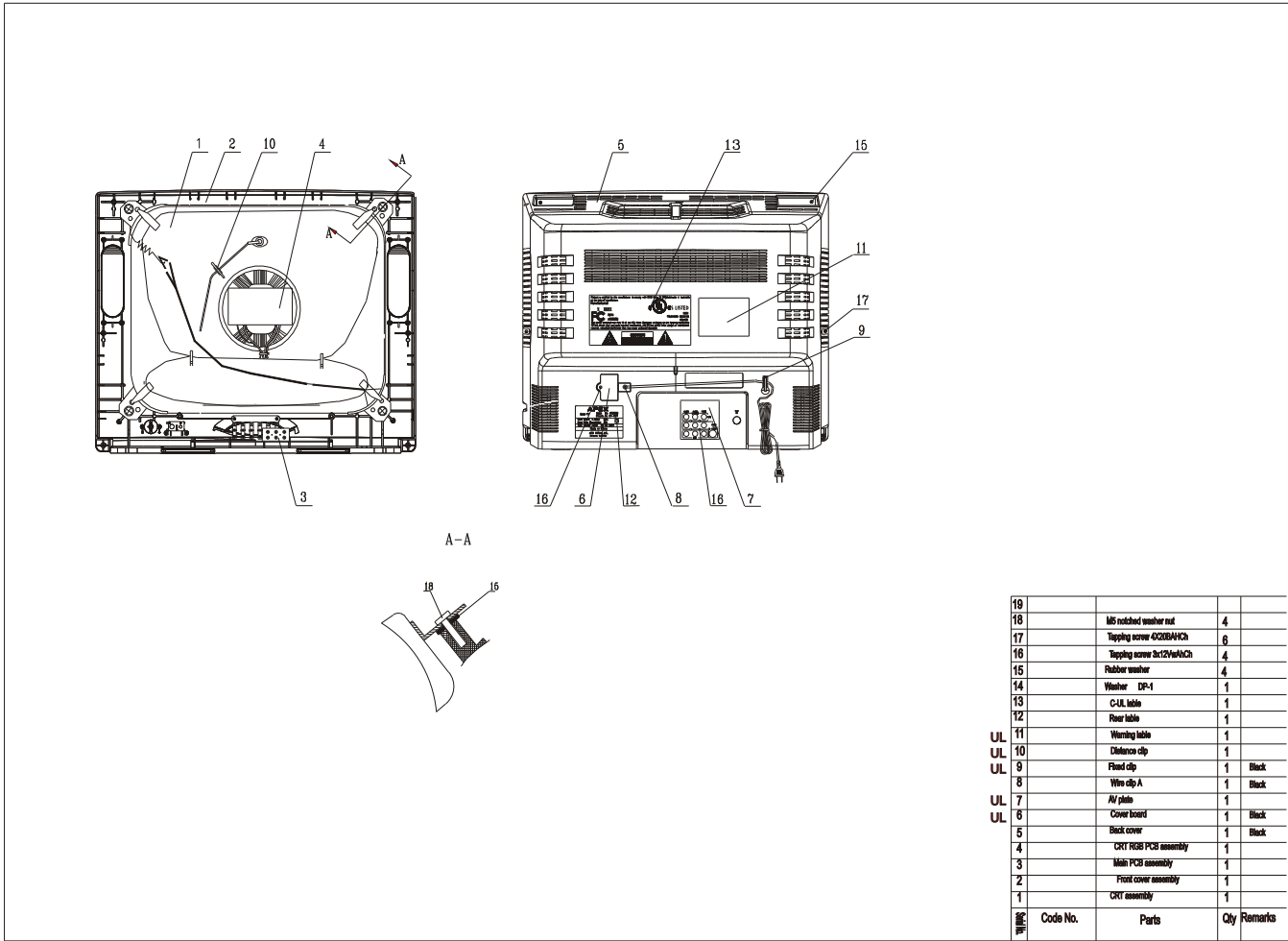


A-A



19				
18		M5 notched washer nut	4	
17		Tapping screw 4X20BAHCh	6	
16		Tapping screw 3x12WwhCh	1	
15		Rubber washer	4	
14		Washer dp-1	1	
13		C.U.L. label	1	
12		Rear label	1	
11		Warning label	1	
UL 10		Distance clip	1	
UL 9		Fused clip	1	Black
UL 8		Wire clip A	1	Black
UL 7		AV plate	1	
UL 6		Cover board	1	Black
5		Back cover	1	Black
4		CRT RGB PCB assembly	1	
3		Main PCB assembly	1	
2		Front cover assembly	1	
1		CRT assembly	1	
Serial No.	Code No.	Parts	Qty	Remarks

APPENDIX 4: FINAL ASSEMBLY DIAGRAM FOR AT2008S



Group component lists of AT2008&AT2008S&KT2006

Part name		CRT Type	Old Part number	New Part number	List Price
Remote control	TYPE: K12B-C1; When using CPU CH04T1228		K12B-C1	8201801690L	\$15.00
Remote control	TYPE:K12B-C2; When using CPU CH04T1222		K12B-C2	8201800032L	\$15.00
CRT assembly	For large-neck CRT, including Samsung, LG, Phillips, Thai, and Seg Hatachi CRT		A51KQK99X01, A511 MV10X02 54SX5=3Y22-DC01	A51JFC82X13, 8537001150C01	\$95.00
CRT assembly	For small-neck IRICO or Shanghai Novel CRT			8537001150C02	\$95.00
CRT assembly	For large-neck Huafei CRT		A51EHW135X96	8537001150C03	\$95.00
CRT assembly	For large-neck BMCC CRT		A51EHW135X96	8537001150C04	\$95.00
Front cover assembly	For front cover			8611606330C01	\$33.54
Back cover				8807401001C	\$22.38
Speaker				56232105080	\$8.00
Power Cord				53410220030	\$4.00
Main PCB assembly	Samsung, Seg Hitachi, LG, Phillips or Thai large-neck CRT (for AT2008S only)		JUC7.820.690	8667211330C01	\$98.00
Main PCB assembly	IRICO or Shanghai Novel small-neck CRT (for AT2008S only)		JUC7.820.690	8667211330C02	\$98.00
Main PCB assembly	When using Huafei large-neck CRT (for AT2008S only)		JUC7.820.690	8667211330C03	\$98.00
Main PCB assembly	When using BMCC large-neck CRT (for AT2008S only)		JUC7.820.690	8667211330C04	\$98.00
Main PCB assembly	When using Samsung, Seg Hitachi, LG, PHILIPS or THAI large-neck CRT (for AT2008 only)		JUC7.820.829	8667211330C11	\$98.00
Main PCB assembly	When using IRICO or Shanghai Novel small-neck CRT (for AT2008 only)		JUC7.820.829	8667211330C12	\$98.00
Main PCB assembly	When using Huafei large-neck CRT (for AT2008 only)		JUC7.820.829	8667211330C13	\$98.00
Main PCB assembly	When using BMCC large-neck CRT (for AT2008 only)		JUC7.820.829	8667211330C14	\$98.00
CRT RGB PCB	For large-neck CRT		JU7.820.1808	8667214210C01	\$98.00
CRT RGB PCB assembly	For small-neck CRT		JU7.820.1630	8667214210C02	\$12.24
Side AV PCB assembly	For AT2008S only		For AT2008S only,JUC7.820.406	8667206640C01	\$12.24
Side AV PCB assembly	For AT2008/KT2006 only		For AT2008/KT2006 only,JUC7.820.406	8667206880C02	\$12.24
Control PCB assembly			JUC7.820.258	8667211380C	\$12.24



APEX DIGITAL TELEVISION In-Warranty Schedule by Model

Product Model No.	LIMITED WARRANTY ¹				Carry-In Service	In Home	Stock Repair	REIMBURSEMENT RATES					
	Parts	Remote Control	Labor	CRT ³	Yes/No	Yes/No	Yes/No	Carry-In		Home Service		Stock	
								Minor	Major	Minor	Major	Repair	
13 inch ²													
AT1302	90	90	90	90	N	N	N	N/A	N/A	N/A	N/A	N/A	
AT1308	90	90	90	90	N	N	N	N/A	N/A	N/A	N/A	N/A	
20 inch ²													
AT2002 / AT2002S	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A	
AT2008 / AT2008S	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A	
GT2011J	365	90	90		N	N	N	N/A	N/A	N/A	N/A	N/A	
GT2011S	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A	
GT2015	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A	
GT2015DV	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A	
KT2006	1 YEAR STORE REPLACEMENT												
24 inch ^{2&3}													
AT2402	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A	
AT2408 / AT2408S	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A	
GT2411S	365	90	90	365									
GT2415	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A	
PF2425	365	90	90	730	N	N	N	N/A	N/A	N/A	N/A	N/A	
KT2406	365	90	90	365	Y	N	N	4	4	4	4	4	
25 inch ²													
AT2502	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A	
AT2502S	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A	
27 inch ³													
AT2702	365	90	90	365	Y	Y	Y	4	4	4	4	4	
AT2702S	365	90	90	365	Y	Y	Y	4	4	4	4	4	
AT2708 / AT2708S	365	90	90	365	Y	Y	Y	4	4	4	4	4	
GT2711S	365	90	90	365	Y	Y	Y	4	4	4	4	4	
GT2715	365	90	90	365	Y	Y	Y	4	4	4	4	4	
PF2725	365	90	90	730	Y	Y	Y	4	4	4	4	4	
GT2715DV	365	90	90	365	Y	Y	Y	4	4	4	4	4	
32 inch ³													
AT3208S	365	90	90	365	Y	Y	Y	4	4	4	4	4	
GT3215	365	90	90	365	Y	Y	Y	4	4	4	4	4	
PF3225	365	90	90	730	Y	Y	Y	4	4	4	4	4	
KT3226	365	90	90	730	Y	Y	Y	4	4	4	4	4	
PROJECTION													
GB4308	365	90	365	730	Y	Y	Y	4	4	4	4	4	
GB43HD09	365	90	365	365	Y	Y	Y	4	4	4	4	4	
GB5108	365	90	365	730	Y	Y	Y	4	4	4	4	4	
GB51HD09	365	90	365	365	Y	Y	Y	4	4	4	4	4	
GB55HD09W	365	90	365	365	Y	Y	Y	4	4	4	4	4	
GB65HD09W	365	90	365	365	Y	Y	Y	4	4	4	4	4	

¹ Limited Warranty is printed on the last page of the owner's manual

² All defective units 13" - 25" during the first 90 days of ownership will be exchanged at the original place of purchase. Dealer may contact APEX to receive a Return Authorization from Apex for credit or exchange.

³ Should the picture tube fail during the In-Warranty period the product will be exchanged. The customer is responsible for the Service Center diagnostic fee after the initial labor warranty period and for all packing, transportation and insurance charges.

⁴ See Master Dealer File for Rates for each Dealer